

MAHARSHI DAYANAND SARASWATI UNIVERSITY, AJMER



पाठ्यक्रम SYLLABUS

SCHEME OF EXAMINATION AND COURSES OF STUDY

FACULTY OF EDUCATION

B.Sc. B.Ed. (New)

B.Sc. B.Ed. Part-I, Part-II, Part-III, Part-IV

(Regional Institute of Education (NCERT), Ajmer

2012-13 से प्रभावी(w.e.f.)

सत्र 2013-14

महर्षि दयानन्द सरस्वती विश्वविद्यालय, अजमेर

NOTICE

1. Change in Statutes/Ordinances/Rules/Regulations/ Syllabus and Books may, from time to time, be made by amendment or remaking, and a candidate shall, except in so far as the University determines otherwise comply with any change that applies to years he has not completed at the time of change. The decision taken by the Academic Council shall be final.

सूचना

1. समय-समय पर संशोधन या पुनः निर्माण कर परिनियमों / अध्यादेशों / नियमों / विनियमों / पाठ्यक्रमों व पुस्तकों में परिवर्तन किया जा सकता है, तथा किसी भी परिवर्तन को छात्र को मानना होगा बशर्ते कि विश्वविद्यालय ने अन्यथा प्रकार से उनको छूट न दी हो और छात्र ने उस परिवर्तन के पूर्व वर्ष पाठ्यक्रम को पूरा न किया हो। विद्या परिषद द्वारा लिये गये निर्णय अन्तिम होंगे।

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ORDINANCES GOVERNING THE B.SC. B.ED. COURSE, RIE SCHEME

The MDS University, Ajmer hereby institutes the following ordinances under RIE Scheme governing admission, courses of study, examination and other matters relating to the degree of B.Sc. B.Ed. under the Faculty of Studies.

1. The course of study shall extend over a period of four years as an integrated course in Science, Education, Work Experience, General Hindi/ General English/History of Indian Civilization, Elementary Computer Applications and Environmental Studies leading to the composite degree of B.Sc. B.Ed.
2. Candidates who have passed +2 examination / intermediate or any other examination recognized as equivalent thereto by the MDS University, Ajmer with at least 45% marks in the aggregate are eligible for admission to the course.
3. There shall be a University examination at the end of each year as per details of the scheme of examination.
4. A candidate will be permitted to appear in the annual examination only if he/she has pursued a regular course of study and attended at least 75% of the classes actually held in each subject.
5. A candidate shall be admitted to the next higher class only if he/she passes his/her I Year/II Year/III Year Examination as per rules mentioned herein after.
6. In order to qualify for B.Sc. B.Ed. degree a candidate should obtain a minimum of 36% marks in theory and practicals separately, wherever applicable in each subject in each year of the course and 40% marks in Internship in Teaching in the Fourth Year.
7. In I Year, there will be three core subjects; Core subject 1(a) is General Hindi/ General English / History of Indian Civilization (for foreign students only), Core Subject 1(b) is Elementary computer applications and Core Subject 1(c) is Environmental Studies. In order to pass, a candidate must secure atleast 36% in each core subject. However, the marks obtained in these papers will not be taken into account for awarding the division. In case a candidate fails in the core subject, he/she has to clear the same as per provision made in clause 12(ii).
8. The minimum pass marks in the supplementary examination shall be the same as prescribed for the main examination. The candidate who has passed any year of B.Sc. B.Ed. course after taking supplementary examination will be awarded minimum pass marks in the concerned subject irrespective of marks actually obtained in the supplementary examination.
 - (i) A candidate who fails in one or two subjects (excluding General

Hindi/General English /History of Indian civilization/Elementary Computer Application/ Environmental Studies in the I Year) in any year of the course will be eligible to take the supplementary examination in the subject(s) in which he/she fails. In case the candidate is not able to pass even in the supplementary examination he/she can appear only as an ex-student in all subjects again at the main examination of the subsequent year. He/she will not be required to appear in practical(s) if he/she has already cleared the same. A candidate shall be deemed to be an ex-student if he/she completed a regular course of study at the Institute and fulfilled the required attendance as specified in clause No. 4 and appeared in University examination but failed or did not take the examination.

- (ii) A candidate who fails in the practical/theory/field work of a subject at the main examination shall be required to appear only in the corresponding practical/ theory of the supplementary examination.
- (iii) A candidate who does not appear in the supplementary examination will have to appear in the subsequent main examination in all subjects including practical only as an ex-student.

A candidate who appears for the supplementary examination may take provisional admission to the next higher class at his own risk. Such a candidate will, however, be allowed to appear in the University examination of the next higher class subject to his/her passing the supplementary examination, fulfilling the attendance requirement as a regular candidate and completion of courses of study as per scheme of examination. If a candidate getting supplementary does not take provisional admission to the next higher class by the notified last date of admission and passes the supplementary examination at a later stage, he/she will not be admitted to the next higher class. However, such a candidate may take admission to the next higher class in the next academic session.

- (i) A candidate who fails in more than two subjects (except General Hindi/General English/ History of Indian Civilization/Elementary Computer Applications/Environmental Studies) in any year of the course shall be declared failed and will not be promoted to the next class. Such a candidate will be permitted to appear at the main examination of the subsequent year in all the subjects only as an ex-student.
- (ii) However, in the case of General Hindi/General English/ History of Indian Civilization, Elementary Computer Applications and Environmental Studies, if a candidate fails in I Year he/she would get two more chances for clearing this paper either along with the supplementary examination in I Year or with the main examination

in II Year. Non-appearance or absence from the examination of this paper will be counted as a chance.

- (iii) A candidate who fails in more than two subjects but passes in practical he/she will be required to appear again in all the subjects (theory) except practical only as an ex-student.
9. A candidate will be given a maximum of three chances at the main examination and the corresponding supplementary examination in any year of the course. If he/she does not pass the examination even thereafter, he/she will be not be eligible for readmission to any year of the course.
10. If a candidate fails in the Internship in Teaching or is unable to complete Internship in teaching but passes in all other subjects he/she will be required to repeat the complete 'Internship in Teaching' in the next academic session along with regular candidates. Division will be awarded to the successful candidates only after the IV year examination and on the basis of cumulative total of marks obtained in all the four years of the course in all the subjects including Internship in Teaching but excluding the core subjects i.e., General Hindi/ General English/ History of Indian Civilization, Elementary Computer Applications and Environmental Studies.

Successful candidates will be awarded division as follows :

i	First Division	60% or more
ii	Second Division	48% or more (but less than 60%)
iii	Third Division	36% or more (but less than 48%)

Note:

A) Subject means:

- (i) Theory and practical in Science.
- (ii) Each Paper in Education
- (iii) Technology/Agriculture component under Work Experience
- (iv) General Hindi/General English/ History of Indian Civilization
- (v) Elementary computer applications
- (vi) Environmental Studies
- (vii) Internship in Teaching.

B) Core subject means:

A compulsory paper in General Hindi/General English/History of Indian Civilization, Elementary computer applications and Environmental Studies for all the candidates in I year of the course.

C) Revaluation:

Candidates can apply for revaluation in any of the subjects except the Core subjects (General Hindi/General English/ History of Indian Civilization, Elementary Computer applications and Environmental Studies) as per university rules in force from time to time.

COURSE STRUCTURE & SCHEME OF EXAMINATION**B.SC. B.ED. PART I EXAMINATION (NEW SCHEME)**

Sl. No	Name of Subject	Paper	Instructional Periods/week	Exam. Duration (hrs.)	Max. Mark	Min. for Pass
1	Core Subjects*					
	a) Gen Hindi/Gen English/History of Indian Civilization	Theory	4	3	100	36
	b) Elementary Computer Applications	Theory Practical	2 2	3 2	60 40	22 15
	c) Environmental Studies	Theory Field work	2 2	3 2	75 25	27 09
2	Physics	I II Practical	3 3 4	3 3 5	50 50 50	36 36 18
3	Chemistry	I II Practical	3 3 4	3 3 3	50 50 50	36 36 18
4	Zoology	I II Practical	3 3 4	3 3 4	50 50 50	36 36 18
5	Botany	I II Practical	3 3 4	3 3 4	50 50 50	36 36 18
6	Mathematics	I II	4 4	3 3	75 75	54 54
7	Work Experience** (Technology/ Agriculture)		3	3	50	18

* Marks will not be added to the aggregate for award of division

** To be evaluated by a team of two members constituted by Principal in consultation with Head, DESM

Distribution of Marks:

Core Subjects :	300*
Science :	450
Work Experience :	50
Total Marks	500

Total periods per week:

PCM	43
CBZ	45

B.SC. B.ED. PART II EXAMINATION (NEW SCHEME)

Sl. No	Name of Subject	Paper	Instructional Periods/week	Exam. Duration (hrs.)	Max. Mark	Min. for Pass
1	Physics	I II III Practical	3 3 3 4	3 3 3 5	50 50 50 50	54 54 54 18
2	Chemistry	I II III Practical	3 3 3 4	3 3 3 5	50 50 50 50	54 54 54 18
3	Zoology	I II III Practical	3 3 3 4	3 3 3 4	50 50 50 50	54 54 54 18
4	Botany	I II III Practical	3 3 3 4	3 3 3 4	50 50 50 50	54 54 54 18
5	Mathematics	I II II	4 3 4	3 3 3	70 65 65	72 72 72
6	Psychology of Learner, Learning & Instruction		4	3	75	27
7	Work Experience** (Technology/ Agriculture)		4	3	50	18

* To be evaluated by a team of two members constituted by Principal in consultation with Head, DESM.

Distribution of Marks:

Core Subjects :	600
Science :	75
Work Experience :	50

Total periods per week:

PCM	45
CBZ	46

Total Marks 725

B.S.C. B.ED. PART III EXAMINATION (NEW SCHEME)

Sl. No	Name of Subject	Paper	Instructional Periods/week	Exam. Duration (hrs.)	Max. Mark	Min. for Pass
1	Physics	I	3	3	50	36
		II	3	3	50	
		Practical	4	5	50	
2	Chemistry	I	3	3	50	36
		II	3	3	50	
		Practical	4	5	50	
3	Zoology	I	3	3	50	36
		II	3	3	50	
		Practical	4	4	50	
4	Botany	I	3	3	50	36
		II	3	3	50	
		Practical	4	4	50	
5	Mathematics	I	4	3	75	54
		II	4	3	75	
6	Instructional Strategies & Skills		4	3	75	27
7	(a) (a) & (b) for (b) CBZ (c) (c) & (d) for (d) PCM (a) Teaching of Bio. Sc. b) Teaching of Chemistry c) Teaching of Physical Science d) Teaching of Mathematics	Theory	3	3	75	27
		Prac.	2			
		Theory	3	3	75	27
		Prac.	2			
		Theory	3	3	75	27
		Prac.	2			
		Theory	3	3	75	27
		Prac.	2			

Distribution of Marks:

Science	:	450
Education	:	225

Total Marks	<u>625</u>
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Total periods per week:

PCM	42
CBZ	44

B.S.C. B.ED. PART IV EXAMINATION

Sl. No	Name of Subject	Paper	Instructional Periods/week	Exam. Duration (hrs.)	Max. Mark	Min. for Pass
1	Physics	I	3	3	50	36
		II	3	3	50	
		Practical	6	5	50	
2	Chemistry	I	3	3	50	36
		II	3	3	50	
		Practical	6	5	50	
3	Zoology	I	3	3	50	36
		II	3	3	50	
		Practical	6	4	50	
4	Botany	I	3	3	50	36
		II	3	3	50	
		Practical	6	4	50	
5	Mathematics	I	4	3	75	54
		II	4	3	75	
6	Education and Indian Society		4	3	75	27
7	School Management		4	3	75	27
8	Internship in Teaching				200	80

Distribution of Marks:

Core Subjects	:	450
Science	:	150
Work Experience	:	200
Total Marks		<u>800</u>

Total periods per week:

PCM	36
CBZ	40

Year wise marks of the four year B.Sc. B.Ed. course

Class	Marks
I Year (New Scheme)	500
II Year (New Scheme)	725
II Year (Old Scheme)	650
III Year (New/Old Scheme)	675
IV Year (Old Scheme)	725
IV year (New Scheme)	<u>800</u>

B.SC. B.ED. PART I EXAMINATION**CORE SUBJECT 1(A)****1 (a) सामान्य हिन्दी**

उत्तीर्णांक : 36

अवधि 3 घंटे

पूर्णांक - 100

निर्देश - इस प्रश्न पत्र के प्राप्तांक श्रेणी निर्धारण में सम्मिलित नहीं किये जायेंगे।

अंक योजना - (अ भाग)

गद्य एवं पद्य संकलन की विविध विधाएं क्रमशः	(25+25 = 50 अंक)
1. एक प्रश्न व्याख्याओं से संबंधित क्रमशः (दो व्याख्याएं)	(10+10 = 20 अंक)
2. दो परिचयात्मक प्रश्न पाठ्य पुस्तकों से	(15+15 = 30 अंक)

(ब भाग)**व्याकरण खंड**

1. शब्द शुद्धि	- 5 अंक
2. वाक्य शुद्धि	- 5 अंक
3. पारिभाषिक शब्दावली (अंग्रेजी शब्दों के हिन्दी समानार्थक शब्द)	- 5 अंक
4. संक्षेपण	- 5 अंक
5. पल्लवन	- 5 अंक
6. वाक्यांश के लिए सार्थक शब्द	- 5 अंक
7. प्रारूप (प्रार्थना पत्र, निविदा, परिपत्र, अधिसूचना, ज्ञापन, विज्ञापन)	- 5 अंक
8. शब्द युग्म - अर्थ भेद	- 5 अंक
9. निबंध	- 10 अंक

पाठ्यपुस्तकें

गद्य प्रभा: संपादक - डॉ. नवल किशोर

प्रकाशक : पंचशील प्रकाशन, फिल्म कालोनी, चौड़ा रास्ता जयपुर मूल्य रु. 15

कविता के आधुनिक सोपान : संपादक - डा. जीवनसिंह, डॉ. भागीरथ भार्गव, प्रकाशक

किरण पब्लिकेशन, पुरानी मंडी, अजमेर, मूल्य रु. 5.50

or**GENERAL ENGLISH**

Duration: 3 Hrs.

Max Marks: 100

Min. for Pass 36

Objectives: This is essentially a language-based course. It aims at making students read English prose with a view to enlarging their comprehension of the language and encouraging them to develop reading habits. It also aims at giving them basic skills in grammar, widening their vocabulary and teaching them to write simple and correct English.

Scheme of Examination**1. Comprehension and Vocabulary**

a	Questions based on content from the prescribed text	10 Marks
b	Questions based on a passage from the prescribed text to test the candidate's comprehension and vocabulary	20 Marks
c	Questions based on an unseen passage to test the candidate's comprehension and vocabulary (There will be a text of essays and short stories between 100 and 200 pages in length.)	10 Marks

2. Composition

a	Letter / Application writing	10 Marks
b	Paragraph writing/précis writing	10 Marks
c	Report Writing	10 Marks

3. Translation

This exercise will require candidates to render into English ten simple sentences in Hindi. At least 15 sentences will be set. 10 Marks

4. Grammar and Usage

The Questions in this exercise will be set with the purpose of testing the candidate's knowledge of grammar and familiarity with correct usage.

A	Elements of a sentence	2 Marks
B	Transformation of Sentences including Active and Passive Voice	2½ Marks
C	Modals	2 Marks
D	Tense Usage	2½ Marks
E	Determiners	2½ Marks
F	Common English Errors	2½ Marks
G	Phrasal Verbs	3 Marks
H	Idioms	3 Marks

Phrasal Verbs

Break	Break away, break down, break off, break up.
Bring	Bring about, bring in, bring up, bring down
Come	Come by, come across, come upon
Carry	Carry out, carry on, carry off, carry over

Call	Call on, call off, call at
Get	Get along, get away with, get by, get through, get over
Give	Give up, give away, give in
Hard	Hard up, hard of hearing, hard nut to crack, hard to please
Look	Look after, look into, look forward to, look up to
Put	Put out, put off, put up, put up with
Run	Run after, run down, run over, run out of
Take	Take after, take up, take to

Idioms

To be born with a silver spoon in one's mouth, to be at daggers drawn, to be at sea, to be in the dark, to be in hot water, to be on the run, to be out of the woods, to be under someone's thumb, to break the ice, to break fresh ground, to make a mountain out of a molehill, to put a spoke in someone's wheel, to put two and two together, to turn a deaf ear, to turn a new leaf, to turn the tables (On someone), to blow one's own trumpet, to burn the candle at both ends, to carry favour, to cut one's coat according to one's cloth, to fish in troubled waters, to hit the nail on the head, to kill two birds with one stone, to know where the shoe pinches, to let the cat out of the bag, to nip something in the bud, to smell a rat, to wash one's hands off something.

The following chapters are prescribed for study:

- | | |
|-----------------------------|--|
| 1. M. K. Gandhi | : Training : Literary and Spiritual |
| 2. Kamla Devi Chattopadhyay | : Indian Women and the Salt Satyagraha |
| 3. Robert Epstern | : Unleash your Creativity |
| 4. Uma Rao | : A Special Child |
| 5. Neelam Saran Gour | : Personal Friend |
| 6. Vandana Shiva | : Women in the Food Chain |
| 7. Boman Desai | : Between the Mosque and the Temple. |

Recommended Books

- | | |
|---------------------------------|---|
| 1. A.J.Thomson and A.V.Martinet | A Practical English Grammar (Oxford Paperback) |
| 2. S.Pit Corder | Intermediate English Practice Book (O.L.) |
| 3. Bhaskaran and Horsburgh | Strengthen Your English (OUP 1973) |
| 4. F.T. Wood (Macmillan 1965) | A Remedial English Grammar for Foreign Students |
| 5. T.L.H.Smith-Pearse | The English Errors of Indian Students OUP |

Book Prescribed

Dr. Jasbir Jain (Ed.)
Macmillan India Ltd.
The Many Worlds of Literature
Rs.25/-

अथवा**प्रारंभिक हिन्दी**

(सामान्य हिन्दी के स्थान पर केवल अहिन्दी भाषी क्षेत्रों से आए हुए छात्रों के लिए) स्कीम न्यूनतम अंक -36

अवधि- 3 घंटा

अधिकतम अंक-100

अंको का विभाजन

- | | |
|---------------------------------|--------|
| 1. पुस्तकों पर आधारित | 50 अंक |
| 2. व्याकरण से संबंधित | 20 अंक |
| 3. रचना से संबंधित | |
| क - लोकोक्तियां तथा मुहावरे आदि | 10 अंक |
| ख - पत्र लेखन अथवा निबंध | 20 अंक |

पाठ्यक्रम

- | | |
|---|---|
| 1. अध्ययनार्थ पाठ्य पुस्तकें | |
| क - निबंध संग्रह | ख - कहानी संग्रह |
| 2. व्याकरण | |
| शब्द विचार, वाक्य विन्यास, वाक्य खंड, पद-क्रम का ज्ञान तथा इसमें होने वाली सामान्य त्रुटियों का ज्ञान | |
| 3. रचना - | |
| क. मुहावरों तथा लोकोक्तियों का प्रयोग वाक्य में रिक्त स्थानों की पूर्ति, समान दीखने वाले शब्दों का अर्थ भेद और वाक्यों में प्रयोग । | |
| ख - पत्र लेखन, अथवा सरल निबंध । | |
| पाठ्य पुस्तकें - | |
| क. निबंध संग्रह | सुगम हिन्दी गद्य संपादक सूरज भान, (प्रकाशक राजपाल एंड संस) |
| ख. गल्पदशिका 2,7 एवं 8 पाठों को छोड़कर | ले. एस. एल. गर्ग एवं कमला भटनागर प्र. कालेज बुक डिपो जयपुर |
| ग. व्याकरण एवं रचना - | सुबोध व्याकरण एवं रचना - सं. श्री व्यथित हृदय संशोधन कर्ता - डा. अम्बाप्रसाद सुमन, श्री राम मेहरा एंड कंपनी |

OR

HISTORY OF INDIAN CIVILISATION

(In lieu of Compulsory Subject of General Hindi for Foreign Students)

Duration : 3 hrs.

Max marks: 100

Min. for Pass: 36

- A) Outline of Historical Development : Indus valley and the Aryans, Rise of Empires- Mauryas and Guptas, Impact of Islam, The Rajputs and Akbar, The British Impact, The National Movement- Gandhi and Nehru.
- B) Social Life and Cultural Heritage : Family, Caste, Education, Buddhism and Jainism, Bhakti Movement, Literary and Art Heritage, Epics, Kalidas, Tulsidas, Tagore, Sanchi, Ajanta, Temple Architecture, Mughal Architecture, and Rajput and Mughal Painting.

Books Recommended :

1. J.N. Sarkar: India Through the Ages
2. Pannikar : Brief Survey of Indian History

1 (B). ELEMENTARY COMPUTER APPLICATIONS

Scheme	Exam Duration	Max. Marks	Min. for Pass
Theory	3 hrs	60	22
Practical	2 hrs	40	15

Multiple choice questions – 120 and Question Paper of four series for theory

1. **Information and communication technology:** Meaning of Data Information, differences between data and information, concepts of Information Technology, Information Society Information Superhighway role of ICT at home, in Education, schools, in Employment and Businesses, in Local Community and in healthcare.
2. **Elements of computer Processing Systems:** What is a computer? Meaning of computer, what computer does, concept of hardware and software, the architecture of a computer system, CPU, memory, and types of input devices, like such as mice, keyboards, trackballs, scanners, touch pads, light pens, joysticks etc output devices like various visual display units (VDU s), screens or monitors, printers such as those commonly available, plotters, speakers, speech synthesizers etc. and storage internal/external hard disk, zip disk, data cartridges, CD-ROM, diskette etc devices, concept of software, categories of software, system software, application software and utilities software.
3. **Classification of computers and processors:** Types of computers, distinguish between main-frame computer, minicomputer, network computer, personal computer, and laptop computer in terms of capacity, speed, cost, and typical users. Concept of the terms intelligent and dumb terminal, Types of processor, generation of Intel processors (Pentium), AMD Athlon family, dual core processor.

4. **Operating System (OS) Concept:** The need of an OS, OS as resource, processor and memory manager, types of operating system, characteristics features of Linux, Windows 2000, Windows XP and Windows Vista operating systems.
5. **Computer and Communication:** Need for data transmission over distances, communication channels, twisted pair, coaxial cable, microwave, radio wave, optical fiber and satellite digital and analog transmission, serial and parallel data transmission, modems, networking of computers, Concept of LAN, MAN and WAN.
6. **Personal Computer Software:** Word processing packages, Spreadsheet packages, presentation packages and data base management packages, Desk-top Publishing, Computer Animation Packages, Multimedia packages antivirus software, and Introduction to MS-Word, MS-Excel & MS-PowerPoint.
7. **Internet Technology :** Concept and how its works, Uses of internet in day to day life, Communicating through Computers, creating an e-mail I.D., e-mail and ftp, POP and IMAP and SMTP for mail and the ftp protocol for file transfer; using The World Wide Web, HTTP and web servers; downloading information; using Search engines, making online reservation for railways & airlines ticket, concept of i-ticket and e-ticket
8. **E-learning:** Concept of e-learning, advantages and growth of e-learning, Goals of e-learning, computer based learning, computer based training, Computer-supported collaborative learning, Pedagogical elements, Communication technologies used in e-learning, Computer-aided assessment and learning design, Benefits of e-Learning versus traditional classroom settings, concept of e-commerce

LABORATORY:

The laboratory exercises will be designed to help in the understanding of the concepts of computer and the utilization in the areas outlined in the theory syllabus. The emphasis should be on practical usage rather than the theoretical concepts only.

Note:

Passing in theory and practical examination separately shall be necessary by securing at least 36% marks. Maximum marks for theory will be 60 and Maximum Marks for practical paper will be 40. Minimum marks for theory and practical shall be 22 and 15 respectively.

The theory Q.P. for academic session 2009-2010 will carry 120 multiple-choice questions of ½ marks each. Question paper of four series shall be printed.

For the session 2005-2006, the practical examination scheme should be as follows

A. Record/Sessionals	10 Marks
B Practical exercise on Window XP	5 Marks
C Practical exercise on MS-Word	Marks
D Practical exercise on MS-Exce.	5 Marks
E Practical exercise on MS -PowerPoint	5 Marks
F Practical exercise on surfing internet, downloads, uploads software/ material.	5 Marks
G Practical exercise on Nero start smart, Glary, windows internet cleaner & picaa utilities.	5 Marks

I C ENVIRONMENTAL STUDIES

Scheme	Exam Duration	Max. Marks	Min. for Pass
Theory	3 hrs.	75	27
Field work		25	

Theory paper will contain nine questions. The students are required to attempt five questions in all including question no. 1 which will be compulsory.

Q.1 Short answer type. Ten questions of 2.5 marks each (compulsory question)

Q.2. to Q.9 Essay type questions of 12.5 marks each (attempt any four)
Fieldwork will be evaluated by the concerned teacher out of 25 marks.
The awards will be sent to the University. The students are required to visit field/sites mentioned in the syllabus under the guidance of a teacher and would submit the report to the concerned teacher for evaluation.

Note:

The marks secured in this paper shall not be counted in awarding the division to a candidate.

The candidate have to clear compulsory paper in three chances.

Non appearing or absent in the examination of compulsory paper will be counted a chance.

BASED ON CORE MODULE SYLLABUS FOR ENVIRONMENTAL STUDIES FOR UNDERGRADUATE COURSES OF ALL BRANCHES OF HIGHER EDUCATION

Unit 1: Concept, definition scope and importance of Environmental Education;

Aim, objectives and nature of Environmental Education.

Unit 2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

a) **Forest resources:** use and over-exploitation, deforestation, case studies.
Timber extraction, mining, dams and their effects on forests and tribal

people.

- b) **Water resources:** Use and over-idolization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems.
- c) **Mineral resources:** Use and exploitation environmental effects of extracting and using mineral resources, case studies.
- d) **Food resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water-logging, salinity, cast studies.
- e) **Energy resources:** Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Case Studies.
- f) **Land resources:** Land as a resources, Land degradation man induced landslides, soil erosion and desertification.
- g) Role of an individual in conservation of natural resources.
- h) Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems

Concept of an ecosystem, Structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids. Introduction; types, characteristic features, structure and function of the following ecosystem: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity and its conservation

Introduction-definition: genetic, species and ecosystem diversity biogeographical classification of India, value of biodiversity: consumptive use, productive use.

Social, ethical, aesthetic and option values, biodiversity at global, national and local levels, India as a mega-diversity nation, hot-spots of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, endangered and endemic species of India, conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Unit 4: Environmental pollution

Definition: causes, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution and nuclear hazards; Role of an individual in prevention of pollution, pollution case studies, disaster management: floods, earthquake, cyclone and lands.

Climate change, global warming, acid rain, ozone hole, nuclear accidents and holocaust. Case studies, Waste land reclamation, Consumerism and waste products.

Unit 5: Social Issues and the Environment

From Unsustainable to sustainable development, Urban problems related to energy, resettlement and rehabilitation of people; its problems and concerns. Case studies, environmental ethics: Issues and possible solutions, population growth, variation among nations population explosion – Family Welfare programme human rights value Education, HIV/AIDS, women and child Welfare, role of Information Technology in Environment and human health, case studies.

Environmental protection Act

Air (Prevention and Control of Pollution) Act.

Wild Life Protection Act.

Forest Conservation Act.

Agencies involved in enforcement of environmental legislation.

Public awareness.

Field Work

- Visit to a local area to document environmental assets- river/forest/grasslands/hill/ mountain.
- Visit to local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds.

Study of simple ecosystems/pond, river, hill slope, etc.

Survey of energy consumption in the locality.

2. PHYSICS

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hrs.	50	36
Paper II	3 hrs.	50	
Practical	5 hrs.	50	18

Note: There will be two experiments . The distribution of marks will be as follows:

Two experiments (one from each group)

each of 15 marks 30 marks

Viva 10 marks

Record 10 marks

Total 50 marks

PAPER I – FRAME OF REFERENCE, MECHANICS AND OSCILLATIONS

Duration 3 hrs.

Max. Marks – 50

Note:- The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. MKSA system of units is to be used. The question paper shall have atleast 30 per cent weightage of problems and numericals.

Unit – I

Inertial frames. Galilean transformation, Non-inertial frames, laws of motion and motion in uniform field, fictitious forces, Displacement, velocity and acceleration in rotating co-ordinate systems, centripetal acceleration, coriolis force and its applications.

Unit – II

Motion under central force, Kelper's laws, Gravitational law and field. Potential due to a spherical body, Gauss and Poisson equations for gravitational self energy.

System of particles, centre of mass, equation of motion, single stage and multistage rocket, energy and momentum conservation, concepts of elastic and inelastic collisions.

Unit – III

Rigid body motion, Rotational motion, Moment of inertia and their products, principal moments and axes, Euler's equations.

Potential well and periodic oscillations, cases of harmonic oscillations, differential equations and its solution, Kinetic and potential energy.

Unit – IV

Simple Harmonic oscillations in - Spring and mass system, Simple and compound pendulum, Torsional pendulum, Bifilar oscillations, Helmholtz resonator, LC circuits, Vibration of a magnet, Oscillation of two masses connected by a spring.

Superposition of two simple harmonic motions of same frequency along the same line, Interference, Superposition of two mutually perpendicular simple harmonic vibrations of same frequency, Lissajou's figures, Cases of different frequency.

Unit – V

Two coupled oscillators, normal modes, N-coupled oscillators, damped harmonic oscillators, power dissipation, Quality factor, Driven harmonic oscillator, Transient and steady state, Power absorption, Resonance in system with many degrees of freedom.

Text and Reference Books

Berkeley Physics Course vol. -1, Mechanics (Mc Graw-Hill)

The Feynman Lectures on Physics, vol-1, R.P. Feynman, R.B. Ligton and M.Sands.(Narosa Publishing House)

P.Khandelwal — Oscillation and Waves, (Himalaya Publishing House, Mumbai)

R.S.Gambhir — Mechanics, (CBS Publishers and Distributors, New Delhi)

R.K.Ghosh — The Mathematics of Waves and Vibrations, (Mc Milan, 1975)

Kakani and Hemrajani — Waves and Oscillation. (CBS Publishers and Distributors, New Delhi.)

PAPER – II**MATHEMATICAL BACKGROUND, PROPERTIES OF MATTER AND ELECTROMAGNETIC WAVES****Duration 3 hrs.****Max. Marks – 50**

Note:- The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. MKSA system of units is to be used. The question paper shall have atleast 30 per cent weightage of problems and numericals.

Unit – I

Scalars and Vectors: dot products, triple vector product, gradient of scalar field and its geometrical interpretation, divergence and curl of a vector field, line, surface and volume integral, Flux of a vector field, Gauss divergence theorem, Green's theorem and Stokes theorem.

Functions of two and three variables, Partial derivatives, geometrical interpretation of total differential of a function of two and three variables, Higher order derivatives and their applications.

Unit – II

Elasticity, Small deformations, Young's modulus, bulk modulus and modulus of rigidity for an isotropic solid, Poisson's ratio, relation among elastic constants. Theory of bending of beams and cantilever, Torsion of a cylinder, Bending moments and Shearing forces.

Unit – III

Kinematics of moving fluids, Equation of continuity, Euler's equation, Bernoulli's theorem, viscous fluids, Streamline and turbulent flow, Poiseuille's law, Capillary tube flow, Reynold's number, Stokes law, Surface tension and surface energy, molecular interpretation of surface tension, Pressure on a curved liquid surface, wetting.

Unit – IV

Electromagnetic induction, Faraday's law (its integral and differential form), Lenz's law, Mutual and Self inductance, Transformers, Energy in a static magnetic field, Measurement of self inductance by Rayleigh's method, Maxwell's displacement current, Maxwell's equations, Electromagnetic field and Energy density.

Unit – V

Plane electromagnetic wave in vacuum, Wave equation for E and B of linearly, circularly and elliptically polarized electromagnetic waves, Poynting vector, Reflection and Refraction at a plane boundary of dielectrics, Polarization by Reflection and total internal Reflection, Faraday effect, Wave in conducting medium, Reflection and Refraction by the ionosphere.

Text and Reference Books:

Berkeley Physics Course, vol. II Electricity and Magnetism, Ed. E.M. Procell (Mc Graw Hill)

Holiday and Resnik, Physics –VI Ed.

D.J. Griffith "Introduction to electrodynamics", (Prentice Hall of India)

A.M. parties, Electromagnetic field.

V.V.Savate, Electromagnetic field and Waves, (Wiley Eastern Ltd., New Delhi.)

S.N. Ghosh, Electromagnetic theory and Wave propagation, (Narosa Publishing House.)

Kakani and Hemrajani, Electromagnetism theory and Problems, (CBS Publishers and Distributors, New Delhi.)

PRACTICALS**Duration : 5 Hours****Max. Marks : 50 Min. Marks for Pass : 18**

Any 12 of the following experiments are to be done. Few more experiments may be set at the institutional level.

Section: A

Study of conservation of momentum in two-dimensional oscillations.

Study of a compound pendulum.

Study of damping of a bar pendulum under various mechanics.

Study of oscillations of a mass under different combinations of springs.

Study of bending of a cantilever or a beam.

Study of torsion of a wire (static and dynamic methods).

Study of flow of liquids through capillaries.

Determination of surface tension of a liquid by different methods.

Study of viscosity of a fluid by different methods.

To study the random decay and determine the decay constant by statistical method.

To determine Poisson's ratio of rubber tube.

Section: B

Study of magnetic field due to a current

Measurement of low resistance by Carey-Foster bridge.

Measurement of inductance using impedance at different frequencies.

Measurement of capacitance using impedance at different frequencies

Study of decay of currents in LR and RC circuits.

Response curve for LCR circuit and resonance frequency and quality factor.

To determine the frequency of A.C. mains.

To study the characteristics of a semi conductor junction diode and to determine forward and reverse resistance.

Conversion of galvanometer into an ammeter.

Conversion of galvanometer into a voltmeter.

To determine the internal resistance of laclanche cell using potentiometer.

Laboratory Tutorials

Elementary Fortran programs, flowcharts and their interpretation.

To print out all natural even/odd numbers between given limits.

To find maximum, minimum and range of a given set of numbers.

To compile a frequency distribution and evaluate moments such as mean, standard deviation, etc.

To evaluate sum of finite series and the area under a curve.

To find the product of two matrices.

To find a set of prime numbers and Fibonacci series.

Motion of a projectile using computer simulation.

Numerical solution of equation of motion.

Motion of particle in a central force field.

To find the roots of a quadratic equation.

3. CHEMISTRY

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I Inorganic Chemistry	3 hrs.	50	36
Paper II Physical Chemistry	3 hrs.	50	
Practicals	5 hrs.	50	18

Paper – I – Inorganic Chemistry

Duration : 3 hrs.

Max. Marks: 50

Note – The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

Unit – I

A. Atomic Structure

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of Ψ and Ψ^2 quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principle, Hund's multiplicity rule. Electronic configuration of the elements, effective nuclear charge.

B. Periodic properties

Atomic and ionic radii, ionization energy, electron affinity and electronegativity – definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

Unit – II

Chemical Bonding

Covalent Bond – Valence bond theory and its limitations, directional

characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2 , and H_2O , MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicentre bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Unit – III

A. Ionic Solids – Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond – free electron, valence bond and band theories.

B. s-Block Elements Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, and introduction to alkyls and aryls.

C. Weak Interactions – Hydrogen bonding, van der Waals forces.

Unit – IV

p-Block Elements

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides and halides of groups 13-16, hydrides of boron-diborane and higher boranes, borazine, borohydrides.

Unit – V

A. Fullerenes, carbides, fluoro-carbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.

B. Chemistry of Noble Gases

A Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

PAPER – II PHYSICAL CHEMISTRY

Duration : 3 hrs.

Max. Marks: 50

Note : The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

Unit – I

A. Mathematical Concepts and Computers

a. Mathematical Concepts

Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like k_x , e^x , x^n , $\sin x$, $\log x$; maxima and minima, partial differentiation and reciprocity relations. Integration of

some useful/relevant functions; permutations and combinations. Factorials. Probability

b Computers

General introduction to computers, different components of a computer, hardware and software, input – output devices; binary numbers and arithmetic; introduction to computer language. Programming, operating systems.

Unit – II

Gaseous States

Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state.

Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical concepts and van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule – Thomson effect)

Unit – III

A. Liquid State

Intermolecular forces, structure of liquids (a qualitative description)

Structural differences between solids, liquids and gases.

Liquids crystals: Difference between liquid crystal, solid and liquid.

Classification, structure of nematic and cholesteric phases. Thermography and seven segment cell.

B. Colloidal State:

Definition of colloids, classification of colloids.

Solids in liquids (sols): properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number.

Liquids in liquids (emulsions); types of emulsions, preparation. Emulsifier.

Liquids in solids (gels); classification, preparation and properties, inhibition, general applications of colloids.

Unit – IV

Solid State

Definition of space lattice, unit cell.

Laws of crystallography-(i) Law of constancy of interfacial angles (ii)

Law of rationality of indices (iii) Law of symmetry. Symmetry elements

in crystals.

x-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

Unit – V

Chemical Kinetics and Catalysis

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions-zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction – differential method, method of integration, method of half life period and isolation method.

Radioactive decay as a first order phenomenon.

Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer.

Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis) Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Catalysis, Characteristics of catalysed reactions, classification of catalysis, miscellaneous examples.

PRACTICALS

A. INORGANIC CHEMISTRY

Semimicro analysis – Cation analysis, separation and identification of ions from Groups I, II, III, IV, V and VI, Anion analysis including interfering anions.

B. ORGANIC CHEMISTRY

Laboratory techniques

Calibration of Thermometer

80-82^o (Naphthalene): 113.5-114^o (Acetanilide),

132.5-133^o(urea), 100^o (Distilled Water)

Distillation

Simple distillation of ethanol-water mixture using water condenser

Distillation of nitrobenzene and aniline using air condenser

Crystallization

Concept of induction of crystallization

Phthalic acid from hot water (using fluted filter paper and stemless funnel)

Acetanilide from boiling water

Naphthalene from ethanol

Benzoic acid from water

Decolorisation and crystallization using charcoal

Decolorisation of brown sugar (sucrose) with animal charcoal using

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gravityfiltration.

Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo Red using 1g decolorizing carbon) from ethanol.

Sublimation (Simple and Vacuum)

Camphor, Nphthalene, phthalic acid and Succinic acid.

C. PHYSICAL CHEMISTRY**Chemical Kinetics**

To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.

To study the effect of acid strength on the hydrolysis of an ester.

To compare the strengths of HCl and H₂SO₄ by studying the kinetics of hydrolysis of ethyl acetate.

To study kinetically the reaction rate of decomposition of iodide by H₂O₂.

Colloids

1. To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi- and trivalent anions.

Viscosity, Surface Tension

To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.

To determine the viscosity of amyl alcohol in water at different concentrations and calculate the excess viscosity of these solutions.

To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

4. ZOOLOGY

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	50	36
Paper II	3 hours	50	
Practical	4 hours	50	18

PAPER I : NON CHORDATA

Duration: 3 Hrs.

Max. Marks: 50

Objectives:

To enable students to understand invertebrates, the organizational hierarchies and complexities, the evolutionary trends in external morphology and internal structure; identification and classification with examples, to enable them to understand various modes of adaptations in animals.

Note: Ten questions will be set, two from each unit. Candidates are required to answer five questions selecting one from each unit

Unit – I

- Outline classification of Protozoa up to order.
- Habit and habitat, structure, nutrition, osmoregulation and reproduction of Paramecium and euglena.
- Locomotion in protozoans- pseudopodial, ciliary and flagellar.
- Nutrition in protozoa
- Reproduction in protozoa.

Unit – II

- Outline classification of Porifera and Coelenterata up to order.
- Habit, habitat, morphology, internal structure, reproduction of Sycon
- Canal system in sponges
- Skeleton in sponges
- Habit, habitat, morphology, internal structure, nutrition and reproduction of Aurelia
- Polymorphism in coelenterates.

Unit – III

- Outline classification of Platyhelminthes and Nematelminthes up to order.
- Habit and habitat, morphology, internal structure, reproduction and life-cycle of Fasciola, Taenia, Ascaris

Unit – IV

- Outline classification of Annelida and Arthropoda up to order.
- Habit and habitat, structure, nutrition, respiration, circulation, excretion, nervous system and reproduction of
 - Hirudinaria
 - Palaemon
- Peripatus: structure and affinities
- Mouth parts and feeding habits of insects.

Unit- V

- Outline classification of Mollusca and Echinodermata up to order.
- Habit and habitat, structure, nutrition, respiration, blood vascular system, excretion and reproduction of Pila
- Torsion in gastropoda
- Habit and habitat, structure, nutrition, respiration, blood vascular system, excretion and reproduction of Asterias
- Larval forms of echinoderms.

Reference:

1. Modern Textbook of Zoology Invertebrates by R.L. Kotpal – (Rastogi Publications, Meerut, 10th Revised Edition)

2. Invertebrate Zoology series (Protozoa to Echinodermata) by R.L. Kotpal – (Rastogi Publications, Meerut).
3. Invertebrate Zoology by E.L. Jordan and P.S. Verma – S. Chand & Co. Delhi).
4. Invertebrate Zoology by J.K. Dhami and P.S. Dhami – S. Chand & Co. Delhi).
5. A Textbook of Invertebrate Zoology by S.N. Prasad - (Kitab Mahal, Allahabad).
6. Life of Invertebrates by Russel and Hunter – (Macmillan).
7. Invertebrate Zoology by R.D. Barnes – (W.B. Saunders, Philadelphia).
8. A manual of Zoology, Vol.1 by Ekamernatha Ayyar (Vishwanathan, Madras).
9. The invertebrate series of L.H. Hyman – (McGraw Hill).
10. A student's textbook of Zoology by Adam Sedgwick Vol. I, II & III – (Central Book Depot, Allahabad).
11. A Textbook of Zoology Vol. I by Parkar and Haswell – (Macmillan).

PAPER II: CYTO-GENETICS

Duration: 3 Hrs.

Max. Marks 50

Objectives:

To enable students to comprehend the modern concepts and applied aspects of cell biology and modern concepts of genetics to create awareness regarding the inheritance.

Note: Ten questions will be set, two from each unit. Candidates are required to answer five questions selecting one from each unit.

Unit – I

Introduction to cell: Discovery, characteristics of prokaryotic (bacterial) and eukaryotic cells (plant and animal cells), cell theory, viruses and viroids.

Cell membrane: Ultra structure, chemical composition, models, unit membrane concept, fluidity, glycocalyx and functions of cell membrane. Modifications (specializations) of plasma membrane.

Transport across cell membrane: Passive transport (osmosis, diffusion), facilitated (mediated) diffusion, active transport (primary and secondary) and endocytosis and exocytosis.

Mitochondria: Morphology, ultra structure, chemical composition, functions. origin, electron transport chain and generation of ATP molecules.

Unit – II

Ultrastructure, types, chemical composition, origin and functions of

- (i) ER and Golgi-complex
- (ii) Lysosome, ribosomes.

- (iii) Centriole,
- (iv) Cilia and flagella.

Unit – III

(a) Nucleus: Occurrence, number, shape, size and structure (nuclear envelopes, nuclear matrix and nucleolus).

Chromosomes: Introduction, discovery, morphology, structure (chromatids, primary and secondary constrictions, nucleolar organizer and telomeres) types, chemical composition and functions. Chromosomal organization: Euchromatin, heterochromatin, nucleosome concept, chromatin packaging.

(b) Cell reproduction: Cell cycle, phases, process and significances of mitosis and meiosis.

(c) Chromosomal mutations-

- (i) Variation in chromosome number (aneuploidy and euploidy).
- (ii) Structural changes in chromosomes (deletion, duplication, inversion and translocation).

Unit – IV

a) Mendelian principles of inheritance – monohybrid and dihybrid crosses, back cross and test cross.

a) Deviation of Mendelism – incomplete dominance, codominance and lethal genes; modifications of 3:1 and 9:3:3:1 ratios with examples. Problems.

b) Gene interactions: Epistasis, complementary, supplementary, duplicate, duplicate genes with cumulative effects and collaborator genes. Problems.

c) Multiple alleles: Characters, examples, pseudoalleles, inheritance of A, b, AB, O and Rh blood groups (antigen – antibody reactions).

Unit V

a) Sex-determination- Genetic (sex chromosome, genic balance and haplodiploidy mechanisms), hormonal and environmental control of sex determinations with examples.

b) Sex-linked inheritance- white eye colour in drosophila, colour blindness and hemophilia in man.

c) Linkage: Definition, difference between linkage and independent assortment, different views, chromosomal theory of linkage, kinds, linkage groups and significances.

d) Crossing over- Definition, mechanism, theories, kinds, frequency, factors affecting crossing over and significances.

References:

1. Cell and Developmental Biology by Sastry, Singh & Tomar - (Rastogi

- Publications, 2008).
2. Cell and Molecular Biology by P.K. Gupta - (Rastogi Publications, 2008).
 3. Cell Biology by C.B. Powar - (Himalaya Publishing House, Bombay).
 4. Cell Biology by De Robertis et al - (W.B. Saunders, Philadelphia).
 5. A textbook of Cytology by R.C. Dalela & S.R. Verma - (Jaiprashnath & Co., Meerut).
 6. Cell Biology by J.D. Burke - (Scientific Book Agency, Calcutta).
 7. Cell Biology: A molecular approach by R.D. Dyson - (Allyn & Bacon, Boston).
 8. Cell Biology by R.M. Dowben - (Harper & Row, New York).
 9. Cell function by L.L. Langley - (Affiliated East West Press, New Delhi).
 10. Cytology by C.D. Darlington.
 11. Cell and Molecular Biology by De Robertis EDP & De Robertis EMI Jr. (1996) - Holt WB Saunders International.
 12. Genetics - P.S. Verma & V.K. Agarwal, S.Chand & Co.
 13. Principles of Genetics - Gardner, Wiley Eastern Pvt. Ltd.
 14. Genetics - Winchester, Oxford IBH Publications.
 15. Genetics - Stickberger, MacMillian Publications.

PRACTICAL

Duration: 4 Hrs.

Max Marks: 50

Min. For pass: 18

Objectives:

To develop in students the skills- of staining and mounting of materials (temporary and permanent); of dissection, display and labeling; of preparation of cultures of invertebrates by using common culture methods; laboratory observation of animals and cell division.

Course Content

1. Study of museum specimens:
Porifera - Sycon, Spongilla, Euplectella, Leucosolenia, Hylonema, Hippospongia, Euspongia; Coelenterata - Hydra, Tubularia, Millepora, Physalia, Porpita Vellela, Aurelia, Tubipora, Alcyonium Gorgonia, Pennatula, Adamsia, Fungia; Helminthes - Fasciola, Taenia solium, Planaria, Ascaris, Ancylostoma; Annelida : Neries, Heteroneries, Aphrodite, Chaetopterus, Arenicola, Pheritima, Hirudinaria; Arthropoda, Palaemon, Eupagurus, Scolopendra, Apis, Peripatus, Mollusax, Chiton, Pila, Aplysia, Helix, Dentalium, Mytilus, Pinctada, Unio, Sepia, Loligo, Octopus; Echinodermata- Antedon, Holothuria Cucumaria, Astropecten, Asterias Echinus

2. Study of Permanent slides
Paramecium, Paramecium in Conjugation, Paramecium binary fission, Euglena, Vorticella, Sycon L.S., Sycon T.S., Hydra L.S., Hydra T.S., Cercaria larva, Metacercaria, Miracidium larva, sporocyst larva, Redia larva, Ascaris male and female T.S., T.S. of Gizzard of Earthworm, T.S. through Pharynx region of Earthworm, T.S. through intestinal region of Earthworm, T.S. through buccal cavity of hirudinaria, Zoa, Metazoa, Nauplius, Mysis, T.S. of gill of unio, T.S. of the shell & mantle of unio. Glochidium larva of unio,
3. Dissect and display the followings:-
(a) Earthworm: Alimentary canal Nervous system, Reproductive system.
(b) Leech: Alimentary canal
(c) Cockroach: Mouthparts, Digestive system, nervous system.
(d) Prawn: Nervous system,
(e) Pila: Nervous system
4. Microscopic preparation of the following:-
Paramecium, Euglena, Sponge spicules, gemmules, Obelia, Hydra, parapodium of neries, statocyst of Prawn, mouth parts of cockroach, radula of pila, gill of unio.
5. Culture of Paramecium, Euglena and Amoeba,
6. Microscope: simple and compound, working mechanism and maintenance.
7. Study of bacterial and eukaryotic cell.
8. Slides of sub cellular components (Cell organelles).
9. Erythrocyte plasma membrane permeability.
10. Study of Karyotype and Idiogram of man.
11. Study of barr bodies in human bucal epithelial cells.
12. Squash preparation of grasshopper or cockroach testis for the study of Meiosis.
13. Drosophila culture and life cycle.
14. Sexual Dimorphism in Drosophila; identification of wild or mutant varieties.
15. Study of salivary gland chromosomes of Drosophila.
16. Problems on pedigree analysis.

5. BOTANY

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	50	36
Paper II	3 hours	50	
Practical	4 hours	50	18

Paper I: Diversity of Microbes (Viruses, Bacteria, Algae and Fungi)

Duration: 3hrs **Max. Marks: 50**

Note: There will be ten questions in all, two from each unit. Students have to answer five questions taking one question from each unit.

Unit - I

Viruses and Bacteria: Structure, Multiplication, transmission and disease symptoms of viruses; Structure and economic importance of mycoplasma; Bacteria - structure, nutrition, reproduction and economic importance, Gram's staining; General account and economic importance of Cyanobacteria.

Unit II

Algae: General characters, occurrence, classification (Fritsch, 1935), Pigment constitution, fine structure of algal plastids, life-cycles, Origin and evolution of sex and thallus in algae.

Cyanophyceae: *Nostoc* and *Oscillatoria*

Unit III

Structure, reproduction and evolutionary significance of following genera:

Chlorophyceae: *Volvox*, *Oedogonium* and *Coleochaete*

Xanthophyceae: *Vaucheria*,

Phaeophyceae: *Ectocarpus*, *Sargassum*

Rhodophyceae: *Polysiphonia*

Unit IV

Fungi: General characters, occurrence, classification (Alexopolus and Mims, 1979; G. C. Ainsworth, 1986), Types of mycelia, structure of fungal cell, fungal flagella, Nutrition and economic importance of fungi. Host-parasite interaction, Control of plant diseases.

Unit V

Structure reproduction and life history of

Mastigomycotina - *Synchytrium* & *Phytophthora*

Ascomycotina - *Saccharomyces*, *Eurotium*, *Peziza*

Basidiomycotina - *Puccinia*, *Agaricus*,

Deuteromycotina - *Cercospora*, *Colletotrichum*,

General account of Lichens

PAPER II: DIVERSITY OF CRYPTOGRAMS

(BRYOPHYTES & PTERIDOPHYTES)

Duration: 3 hrs.

Max. Marks: 50

Note: There will be ten questions in all, two from each unit. Students have to answer five questions selecting one from each unit.

Unit I

General characters, distribution, origin of the land habit in plants, classification, Evolutionary trends in thallus and sporogonium development; Alternation of generations; classification; and Economic importance of Bryophytes.

Unit II

Structure, reproduction, and evolutionary significance of following genera:

Hepaticopsida - *Marchantia*

Anthocerotopsida - *Anthoceros*

Bryopsida - *Funaria*

Unit III

General characters, distribution, classification, stelar evolution, heterospory and origin of seed habit, and life cycles in pteridophytes. Structure, reproduction and evolutionary significance of the following genera:

Psilotum; *Lycopodium*

Unit IV

Structure, reproduction and evolutionary significance of the following genera:

Selaginella; *Equisetum*; *Pteris* and *Marsilea*.

Unit V

Geological time scale, fossils and fossilization processes, significance of fossils.

Study of the following form genera of fossils

(a) *Rhinia*

(b) *Calamites*

(c) *Glossopteris*

PRACTICALS

Duration: 4 hours

Max. Marks: 50

Min. for Pass: 18

Course Content:

Study of the genera included in Theory syllabus of Algae and Fungi by making temporary micro preparations and observation of permanent slides.

Observation of disease symptoms in host infected by Fungi, Bacteria, Viruses and Mycoplasma. Section cutting of diseased material and

- Identification of the pathogens as per the theory syllabus.
- Study of morphology, anatomy and reproductive structures of genera included in Bryophytes and Pteridophytes by making temporary micro preparations and observation of permanent slides.
- Gram staining of bacteria.
- Study of crustose, foliose & fruticose Lichens.
- Maintenance & submission of a record of all the Laboratory activities.

6. MATHEMATICS

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	75	54
Paper II	3 hours	75	

PAPER I (CALCULUS)

Duration: 3 hrs **Max. Marks: 50**

Note: In this question paper ten questions will be set, two questions from each unit. Candidates have to answer five questions taking one question from each unit.

Unit I

Partial differentiation, Change of variables Euler's theorem on homogeneous functions, Taylor's theorem for functions of two variables, Jacobians, Maxima, Minima and Saddle points of functions of two variables, Lagrange's multiplier method.

Unit II

Envelopes and Evolutes, Asymptotes, Curvature, Tests for Concavity and Convexity, Points of inflexion, Multiple points, Curve tracing in Cartesian and Polar co-ordinates (Standard curves).

Unit III

Beta and Gamma functions, Double integrals, Change of order of integration in double integrals, Triple integrals, Dirichlet's integral.

Unit IV

Quadrature, Rectification, Volume and Surfaces of solids of revolution.

Unit V

Linear equations and equations reducible to the linear form, Exact differential equations, Integrating Factors, First order and higher degree equations solvable for x,y,p. Clairaut's form and singular solutions, Geometrical meaning of a differential equation, Orthogonal trajectories.

PAPER II (VECTORS AND GEOMETRY)

Note: In this question paper ten questions will be set, two questions from each unit. Candidates have to answer five questions taking one question from each unit.

Unit I

Differentiation of Vectors, Gradient, Divergence and Curl, Identities involving these operators and related problems.

Unit II

Integration of vectors, Theorems of Stock, Green and Gauss (Statements and Verification only).

Unit III

General equation of second degree, Tracing of conics, Polar equation of a conic.

Unit IV

Sphere, Cone and Cylinder.

Unit V

The Central Conicoids, Ellipsoids, Paraboloids, Plane sections of Conicoids.

7. WORK EXPERIENCE: ELECTRICITY

Duration: 3 hours

Max. Marks: 50

Min. for pass :18

(Internal Examination)

Unit 1

Precautions used for making any electrical connection, conductors & insulators. Symbols for electrical components, knowledge of electrical accessories and their rating.

Unit II

Tools used for making any electrical connection, their size and use.

Unit III

Series and parallel connections of lamps (upto four lamps). Staircase wiring of one, two and three lamps, Godown wiring connection and working of tube light. Connection fan. Knowledge of Power consumed in different electrical gadgets.

Unit IV

Different types of wire, use of SWG, Different types of wiring such as – Batten wiring CTS wiring, casing capping wiring, Cleat and conduit wiring. Their advantage and disadvantage on each other. Selection of fuse wire. Selection of fuse wire and use of DP and T.P. switches.

Unit V

Testing of energy meter, connection of energy meter and checking of

electrical bills. Construction of Multimeter and knowledge of measuring the current, voltage and resistance in any circuit by using multimeter.

7. WORK EXPERIENCE: AGRICULTURE

Duration: 3 hours

Max. Marks: 50

Min. for pass: 18

(Internal Examination)

Unit I

Agriculture: Meaning, definition, scope, history, branches and objectives.

Unit II

Soil Science: Definition of subject, soil management, soil erosion, soil conservation practices; structure of soil, soil profile; soil fertility and productivity, essential plant nutrients. Fertilizers and manures including bio-fertilizers. Identification of manures and fertilizers.

Unit III

Irrigation: Definition, methods of irrigation, systems of irrigation, drainage, irrigation pattern of India.

Unit IV

Horticulture: Definition, branches of horticulture, layout of orchards, propagation by seeds and by vegetative means; Pot filling technique; Planning, planting and maintaining lawn; Practice related to landscaping.

Unit V

Agricultural practices: Preparation of land, selection of seeds, watering, thinning, hoeing and weeding, harvesting of crop, identification of important agricultural tools, trees and crop plants Minor project preparation on agriculture.

B.SC.B.ED PART II EXAMINATION

1. PHYSICS

Scheme	Exam. Duration	Max. Marks	Min. Marks for Pass
Paper I Electricity and Magnetism	3 hrs.	50	54
Paper II Kinetic theory and Thermodynamics	3 hrs.	50	
Paper III Waves, Acoustics and Optics	3 hrs.	50	18
Practicals	5 hrs.	50	

PAPER I : ELECTRICITY AND MAGNETISM

Duration : 3 hours.

Max. Marks : 50

Note – The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. MKSA system of units is to be used. The question paper shall have atleast 30 per cent weightage of problems and numericals.

Unit – I

Electrostatics

Coulomb's law in vacuum expressed in vector form, calculations of E for simple distributions of charges at rest, dipole and quadruple fields. Work done on a charge in an electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Electric potential ϕ , $E = -\nabla\phi$, torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application for finding E for symmetric charge distributions, Gaussian pillbox, fields at the surface of a conductor. Screening of E field by a conductor, capacitors, electrostatic field energy, force per unit area of the surface of a conductor in an electric field, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor.

Unit - II

Dielectrics

Parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, displacement vector D, molecular interpretation of Clausius-Mossotti equation, boundary conditions satisfied by E and D at the interface between two homogenous dielectrics, illustration through simple example.

Unit - III

Electric Currents (steady and alternating)

Steady current, current density J, non-steady currents and continuity equation, Kirchoff's law and analysis of multiloop circuits, rise and decay of current in LR and CR circuits, decay constants, transients in LCR circuits, AC circuits, complex numbers and their applications in solving

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AC circuit problems, complex impedance and reactance, series and parallel resonance, Q factor, power consumed by an AC circuit, power factor. Y and ∇ networks and transmission of electric power.

Unit - IV**Magnetostatics**

Force on a moving charge; Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio.

Motion of charged particles in electric and magnetic fields

Linear accelerator, E as deflecting field – CRO, sensitivity, Transverse B field, curvatures of tracks for energy determination of nuclear particles; principle of a cyclotron. Mutually perpendicular E and B fields – mass spectrograph, velocity selector its resolution. measurement of capacitance using impedance at different frequencies. Response curve for LCR circuit and resonance frequency and quality factor.

Unit - V

Biot and Savart's Law, calculation of H order in simple geometrical situations, Ampere's Law, $\nabla \cdot \mathbf{B} = 0$, $\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$, field due to a magnetic dipole, magnetization current, magnetization vector, Half order field, magnetic permeability (linear cases), interpretation of a bar magnet as a surface distribution of solenoidal current.

Text and reference Books

Berkeley Physics Course; Electricity and Magnetism, Ed. E.M. Purcell (McGraw-Hill).
Halliday and Resnik; Physics, Vol 2. (Wiley Eastern)
D.J. Griffith; Introduction to Electrodynamics (Prentice-Hall of India).
Reitz and Milford; Electricity and Magnetism (Addison-Wesley).
A.S.Mahajan and A A Rangwala; Electricity and Magnetism (Tata McGraw-Hill).
A.M. Portis; Electromagnetic Fields.
Pugh and Pugh; Principles of Electricity and Magnetism (Addison-Wesley).
Panofsky and Phillips; Classical Electricity and Magnetism (India Book House).
S.S.Atwood; Electricity and Magnetism (Dover).

PAPER II: KINETIC THEORY AND THERMODYNAMICS

Duration : 3 hours.

Max. Marks : 50

Note – The paper is divided in five independent units. Two questions will be set from each unit. Candidates are required to attempt one question from each unit. 30% weightage will be given to problems and numericals.

Unit - I**Kinetic theory of matter**

Ideal Gas: Kinetic model, deduction of Boyle's law, interpretation of temperature, estimation of rms speeds of molecules. Brownian motion, estimate of the Avogadro number. Equipartition of energy, specific heat of monoatomic gas, extension to di- and triatomic gases, Behaviour at low temperatures. Adiabatic expansion of an ideal gas, applications to atmospheric physics.

Real Gas: Van der Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves. The critical constants, gas and vapour. Joule expansion of ideal gas and of a Van der Waals gas, Joule coefficient, estimates of J-T cooling.

Unit - II

Liquefaction of gases: Boyle temperature and inversion temperature. Principle of regenerative cooling and of cascade cooling, liquefaction of hydrogen and helium. Refrigeration cycles, meaning of efficiency. **Transport phenomena in gases:** Molecular collisions, mean free path and collision cross sections. Estimates of molecular diameter and mean free path. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.

Unit-III**Thermodynamics**

The laws of thermodynamics: The Zeroth law, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as a state function and other applications. reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics. Different versions of the second law, practical cycles used in internal combustion engines. Entropy, principle of increase of entropy. The thermodynamic scale of temperature; its identity with the perfect gas scale. Impossibility of attaining the absolute zero; third law of thermodynamics.

Unit - IV

Thermodynamic relationships: thermodynamic variables; extensive and intensive, Maxwell's general relationships, application to Joule – Thomson cooling and adiabatic cooling in a general system, Van der Waals gas, Clausius-Clapeyron heat equation. Thermodynamic potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

Unit - V

Blackbody radiation: Pure temperature dependence, Stefan-Boltzmann law, pressure of radiation. Special distribution of BB radiation, Wein's displacement law, Rayleigh-jean's law, Planck's quantum postulates. Planck's law, complete fit with experiment. interpretation of behaviour of specific heats of gases at low temperature.

Text and Reference Books

1. M.W.Zemansky Heat and Thermodynamics (Mcgraw-Hill Book Company)
2. M.N. Saha, B.N.Srivastava A Treatise on Heat (The Indian Press, (Publication) Pvt. Ltd. Allahabad)
3. M.N. Saha, B.N.Srivastava A Textbook of HeatA (Science Book Agency, Calcutta)
4. A. N. Matveev Molecular Physics (Mir Publishers, Moscow, 1985)
5. Joseph O. Hirschfelder et al Molecular Theory of Gases and Liquids (John Wiley & Sons, Newyork)
6. K.S. Pitzer, L. Brewer Thermodynamics (Mc Graw Hill Book Company)
7. S.C.Garg, R.M. Bansar, C.K. Ghosh Thermal Physics (Tata McGraw Hill Publishing Company Ltd.)
8. Samuel Glasston, Thermodynamics for Chemists (Affiliated East West Press Pvt. Ltd., New Delhi)
9. Yu. B. Rumer, M. Sh. Ryvkin Thermodynamics, Statistical Physics and Kinetics (Mir Publishers, Moscow)
10. S.S. Singhal, J.P. Agarwal, Satya Prakash Heat and Thermodynamics (Pragati Prakashan, Meerut).
11. सक्सेना, सिंह, रावत 'ऊष्मागतिकी तथा सांख्यिकीय भौतिकी' (कॉलेज बुक हाऊस, जयपुर)
12. मण्डारी, शिशोदिया, परांजपे, वीरेन्द्र कुमार, 'सांख्यिकीय एवं ऊष्मागतिकीय भौतिकी' (रमेश बुक डिपो, जयपुर)

PAPER III: OPTICS**Duration : 3 hours.****Max. Marks : 50**

Note – The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. MKSA system of units is to be used. The question paper shall have atleast 30 per cent weightage of problems and numericals

Unit - I**Geometrical Optics**

Fermat's principle: Principle of extremum path, deduction of laws of reflection and refraction from Fermat's principle.

General theory of image formation: Cardinal points of an optical system, general relationships, thick lens and lens combinations. Lagrange equation of magnification, telescopic combinations and eyepieces.

Unit II

Aberration in images: Chromatic aberrations, achromatic combination of lenses in contact and separated lenses. Monochromatic Aberration and corrections; aplanatic points of a spherically refracting surface and sphere, oil immersion objectives, meniscus lens.

Optical instruments: entrance and exit pupils, need for a multiple lens eyepiece, common types of eyepieces.

Unit – III**Physical Optics**

Interference of a light: The principle of superposition, two-slit interference, optical path retardations, lateral shift of fringes, Rayleigh refractometer and other applications. localized fringes; thin films, Newton's rings, applications for precision measurements for wavelength. **Haidinger fringes:** fringes of equal inclination. Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines. Intensity distribution in multiple beam interference, Fabry-Perot interferometer and etalon.

Unit - IV

Fresnel diffraction: Fresnel half-period zones, plates, straight edge, rectilinear propagation.

Fraunhofer diffraction: Diffraction at a slit, half-period zones, phasor diagram and integral calculus methods, the intensity distribution, diffraction at a circular aperture, and a circular disc, resolution of images. Rayleigh criterion, resolving power of telescope and microscopic systems.

Unit V

Diffraction gratings: Diffraction at N parallel slits, intensity distribution, plane diffraction grating, reflection grating and blazed gratings. Concave grating and different mountings. Resolving power of a grating and comparison with resolving powers of prism and of a Fabry-Perot etalon. **Double refraction and optical rotation:** Refraction in uniaxial crystals, its electromagnetic theory. Phase retardation plates, double image prism. Rotation of plane of polarization, origin of optical rotation in liquids and in crystals.

Text and Reference Books

1. A. K. Ghatak, Physical Optics – Tata McGraw-Hill Publishing Co. Ltd, New Delhi.
2. D. P. Khandelwal: Optics and Atomic Physics (Himalaya Publishing House, Bombay, 1988).
3. F. Smith and J. Thomson; Manchester Physics series; Optics (English Language book Society and John Wiley, 1977).
4. Bom and Wolf; Optics.
5. K. D. Moltev; Optics (Oxford University Press)
6. Sears; Optics.
7. Jenkins and White; Fundamental of Optics (McGraw-Hill)
8. Smith and Thomson; Optics (John Wiley and Sons).

PRACTICALS**Duration: 5 hours****Max. Marks: 50****Min. Marks for Pass: 18**

Any twelve out of the following experiments are to be conducted. Few

more experiments may be set at the institutional level.

1. Determination of wavelength of light using diffraction grating.
2. To find out the wavelength of a monochromatic source of light using Newton's rings and find the refractive index of liquid.
3. Find out the wavelength of a given monochromatic (Sodium light) source using Michelson's interferometer and determination of D_1 & D_2 .
4. Determination of wavelength using Biprism.
5. Determine the specific rotation of sugar solution by polarimeter.
6. Study of polarization by reflection from a glass plate with the help of Nichol prism and photo cell and verify Brewster's law.
7. Find out the melting point of a given substance using platinum resistance thermometer.
8. Determine thermal conductivity of a bad conductor by Lee's method.
9. Determine the thermodynamic constant γ -Cp/Cv using Clements's and Desormas method.
10. Study of variation of total thermal radiation with temperature.
11. Determination of stefan's constant.
12. Study thermo emf versus temperature of a thermo couple. Find the neutral temperature and use it to find temperature of an unknown substance.
13. Study the magnetic field along the axis of a current carrying circular coil for different currents Plot the observations on a graph and find out the radius of a circular coil.
14. Determination of band gap using a junction diode.
15. Determination of power factor ($\cos \theta$) of a given coil using CRO.
16. Determination of velocity of sound in air by standing wave method using speaker microphone and CRO.
17. Measurement of inductance of a coil by Anderson's bridge.
18. Measurement of Capacitance and dielectric constant of a liquid by desauty bridge.
19. Determination of a small thickness by interference method.
20. Study the characteristics of a transistor and determine alpha and beta values.
21. Determination of Resolving Power of Telescope.

Laboratory tutorials

1. Calculation of days between two dates of a year
2. To check if triangle exists and the type of the triangle
3. To find the sum of the sine and cosine series and print out the curve
4. To solve simultaneous equations by elimination method.
5. To prepare a mark-list of polynomials.
6. Fitting a straight line or a simple curve a given data.
7. Convert a given integer into binary and octal systems and vice versa
8. Inverse of a matrix
9. Spiral array

2. CHEMISTRY

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I Inorganic Chemistry	3 hrs.	50	} 54
Paper II organic Chemistry	3 hrs.	50	
Paper III Physical Chemistry	3 hrs.	50	
Practicals	5 hrs.	50	18

PAPER – I – INORGANIC CHEMISTRY

Duration : 3 hrs.

Max. Marks: 50

Note – The paper is divided in five independent units. Two questions will be set from each unit. Candidates are required to attempt one question from each unit.

Unit I

Chemistry of Elements of First Transition Series
Characteristic properties of d-block elements.

Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Unit II

Chemistry of Elements of Second and Third Transition series

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

Unit III

(a) Oxidation and Reduction

Use of redox potential data-analysis of redox cycle, redox stability in water – Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

(b) Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit IV

(a) Chemistry of Lanthanide elements

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

(b) Chemistry of Actinides

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from Uure, similarities between the later actinides and the later lanthanides.

Unit V

(a) Acids and Bases

Arrhenius, Bronsted-Lowery, the Lux-flood, solvent system and Lewis

concepts of acids and bases.

(b) **Non-aqueous Solvents**

Physical properties of a solvent, types of solvents and their general characteristics reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2 .

PAPER – II ORGANIC CHEMISTRY

Duration : 3 hrs.

Max. Marks: 50

Note – The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

Unit - I

A. Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

B. Mechanism of Organic Reactions

Curved arrow notation, drawing electron movements with arrows, half-headed and double headed arrows, homolytic and heterolytic bond breaking. Types of reagents: electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates- carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with example). Assigning formal charges on intermediates and other ionic species.

Methods of determination of reaction mechanism (products analysis, intermediates, isotope effects, kinetic and stereochemical studies.)

Unit – II

Stereochemistry of Organic Compounds

Concept of isomerism. Types of isomerism. Optical isomerism-elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism – determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism – conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

Unit – III

A. Alkanes and Cycloalkanes

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes.

Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity Cycloalkanes – nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

B. Alkenes

Nomenclature of alkenes, methods of formation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes: mechanism involved in hydrogenation, electrophilic and free radical additions. Markownikoff's rule, hydroboration followed by oxidation. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO_4 . Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

Unit – IV

A. Cycloalkenes, Dienes and alkynes

Methods of formation, conformation and chemical reactions of cycloalkenes.

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes (allenes).

Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels – Alder reaction.

Nomenclature, structure and bonding in alkynes. methods of formation. Chemical reactions of alkynes, acidity of alkynes. mechanism of electrophilic and nucleophilic addition reactions, hydroboration followed by oxidation, metal – ammonia reductions, oxidation and polymerization.

B. Alkenes and aromaticity

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture.

Aromaticity: the Huckle rule, aromatic ions.

Unit – V

A. Aromatic electrophilic substitution-general pattern of the mechanism, role of σ and π

Complexes. Mechanism of nitration, halogenation, sulphonation,

mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction.

B. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl.

C. Alkyl and Aryl Halides

Nomenclature and classification of alkyl halides, Methods of formation, chemical reactions:

Mechanisms of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams.

Polyhalogen compounds: chloroform, carbon tetrachloride.

Methods of formation of aryl halides: nuclear and side chain reactions. The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions.

Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

PAPER – III – PHYSICAL CHEMISTRY

Duration : 3 hrs.

Max. Marks: 50

Note – The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

Unit – I

Thermodynamics – I

Definition of thermodynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials.

Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy.

Heat capacity, heat capacities at constant volume and pressure and their relationship.

Joule's law-joule-thomson coefficient and inversion temperature. Calculation of w , q , dU , & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermo chemistry: standard state, standard enthalpy of formation – Hess's Law of heat summation and its applications. Heat of reaction at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy, Kirchhoff's equation.

Unit – II

Thermodynamics – II

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of entropy: entropy as a state function, entropy as a function

of V & T , entropy as a function of P & T , entropy change in physical change, clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third law of thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G with A with P , V and T .

Unit – III

(a) Chemical Equilibrium

equilibrium constant and free energy. Thermodynamic derivation of law of mass action.

Le Chatelier's principle.

Reaction isotherm and reaction isochore – Clapeyron equation and Clausius – Clapeyron equation, applications.

(b) Phase Equilibrium

statement and meaning of the terms – phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO_2 and S systems.

Phase equilibria of two component system – solid – liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead.

Solid solutions – compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($NaCl-H_2O$), ($FeCl_3-H_2O$) system. Freezing mixtures, acetone-dry ice.

Liquid-liquid mixtures- Ideal liquid mixtures, Raoult's and Henry's law.

Non-ideal system-azeotropes- $HCl-H_2O$ and ethanol – water systems.

Partially miscible liquids – Phenol-water, trimethylamine-water, nicotine-water systems.

Lower and upper consolute temperature. Effect of impurity on consolute temperature.

Immiscible liquids, steam distillation.

Nernst distribution law-thermodynamic derivation, applications.

Unit – IV

Electrochemistry-I

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations.

Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only).

Transport number, definition and determination by Hittorf method and moving boundary method.

Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Unit - V

Electrochemistry - II

Types of reversible electrodes - Zn -metal ion, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions (ΔG , ΔH , and K), polarization, over potential and hydrogen overvoltage.

Concentration cell with and without, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pK_a , determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.

Buffers-mechanism of buffer action, Henderson-Hasselbalch equation. Hydrolysis of salts.

Corrosion-types, theories and methods of combating it.

PRACTICALS

Duration: 5 hours

Max. Marks: 50

A. Inorganic Chemistry

Quantitative Analysis

Volumetric Analysis

- Determination of acetic acid in commercial vinegar using NaOH
- Determination of alkali content - antacid tablet using HCl.
- Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- Estimation of ferrous and ferric by dichromate method.
- Estimation of copper using thiosulphate.

B. Organic Chemistry

Determination of melting point

Naphthalene, Benzoic acid, Urea, Succinic acid, Cinnamic acid, Salicylic acid

Acetanilide, m-Dinitrobenzene p-Dichlorobenzene, Aspirin

Determination of boiling points

Ethanol, Cyclohexane, Toluene, Aniline and Nitrobenzene

Qualitative Analysis

Detection of extra elements (N, S and halogens), solubility behaviour and functional groups (Alcoholic, phenolic, carboxylic, carbonyl, esters,

carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

Identification of an organic compound through the functional group analysis, determination of melting point/boiling point and preparation of suitable derivatives.

C. Physical Chemistry

- Determination of the transition temperature of the given substance by thermometric/dilatometric method (e.g. $MnCl_2 \cdot 4H_2O/SrBr_2 \cdot 2H_2O$).

Phase Equilibrium

- Study of the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
- Construction of the phase diagram of two component (e.g. diphenylamine benzophenone) system by cooling curve method.

Thermochemistry

- Determination of the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
- Determination of the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
- Determination of the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Distribution Law

- Determination of the distribution coefficient for the distribution of iodine between water and CCl_4 .
- Study the distribution of benzoic acid between benzene and water.

3. ZOOLOGY

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	50	54
Paper II	3 hours	50	
Paper III	3 hours	50	
Practical	4 hours	50	18

PAPER I: CHORDATA

Duration : 3 hrs.

Max. Marks: 50

Objectives:

To enable students to understand in respect of vertebrates; their organizational hierarchies and complexities; the evolutionary trends in external morphology and comparative studies of internal structures; identification and classification with examples; to enable them to understand various modes of adaptations in animals.

Note: Ten questions will be set, two from each unit. Candidates are required

to answer five questions selecting one from each unit.

Unit-I

Habit and habitat, structure, reproduction (excluding development) and affinities of following types:-

- Hemichordata: Balanoglossus
- Urochordata: Herdmania, ascidian tadpole larva and its metamorphosis.
- Cephalochordata: Amphioxus

Unit - II

Habit, habitat, structure (morphology, digestive system, respiratory system, blood vascular system, nervous system – central and peripheral and urinogenital system) of the following types:-

- Agnatha: Petromyzon (including its affinities)
- Pisces: Scoliodon (including sense organs)
- Scales and fins of fishes.

Unit – III

Habit, habitat, structure (morphology, digestive system, respiratory system, blood vascular system, nervous system – central and peripheral, urinogenital system) of the following types:-

- Amphibia – Rana
- Reptilia: Uromastix
- Poisonous and non-poisonous snakes, poison apparatus & biting mechanism.

Unit - IV

Habit, habitat, structure (morphology, digestive system, respiratory system, blood vascular system, nervous system – central and peripheral, urinogenital system) of the following types:-

- Aves: Columba
- Mammal: Rabbit.
- Origin of birds.

Unit – V

- An outline classification of chordates up to orders but up to subclasses only in case of protochordate groups and mammals.
- Parental care in amphibia.
- Migration of birds.

References:

- Modern Textbook of Zoology: Vertebrates by R.L. Kotpal – Rastogi Publications, Meerut, 3rd edition, 2008.
- A Textbook of Zoology Vol.II by Parkar and Hasswel – (MacMillan).
- A Textbook of Zoology Vol.II by R.D. Vidyarthi – (S.Chand & Co., Delhi).
- Life of Vertebrates by J.Z.Young – (Oxford University Press).
- The Vertebrates by A.S.Romer – (Vakils, Ferrer & Simons, Bombay).
- Elements of Chordate Anatomy by Weichert - (McGraw Hill).
- The Birds by R.L. Kotpal (4th edition) – (Rastogi Publications, 2008).
- Bird Migration by D.R. Griffin – (Doubleday, Garden City, USA).
- The Book of Indian birds by Salim Ali.

- Fish and Fisheries by K. Pandey and J.P. Shukla (2nd Edition) (Rastogi Publications, 2008).
- Indian Fishes by Qureshi and Quréshi – (Brij Brothers, Bhopal).
- Comparative anatomy of the vertebrates by George C Kent – 3rd saint Louis: The C.V. Mosby Company, 1973.

PAPER II ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY

Duration : 3 Hours

Max. Marks : 50

Objectives:

To enable students to comprehend the modern concepts of physiological aspects on various organs and systems of animals and human being to comprehend chemical nature, biological molecules and physiological roles.

Note: Ten questions will be set, two from each unit. Candidates are required to answer five questions selecting one from each unit.

Unit I

- Physiology of digestion: Chemical nature of food stuff (including micronutrients), various types of digestive enzymes and their digestive action in the alimentary canal, role of GI hormones in digestion, mechanism of absorption of digested food.
- Physiology of respiration: Mechanism and control of breathing, exchange of gases transport of respiratory gases (oxygen and carbon dioxide).

Unit II

- Physiology of blood circulation:
 - Composition and function of blood.
 - Blood groups (ABO and Rh).
 - Blood coagulation – factors, mechanism, theories and anticoagulants.
 - Origin, conduction and regulation of heart beat in mammals.
 - Cardiac cycle, ECG.

Unit – III

- Nerve physiology: structure and types of neuron, origin and conduction of nerve impulse,
- Synapse-structure, types, properties and signal transmission through synapses.
- Muscle physiology: Ultra-structure and mechanism of contraction of skeletal muscle, summation and fatigue.

Unit-IV**Endocrinology**

- Hormones: Classification, properties of hormones.

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- b) Mechanism of hormone action (peptide and steroid hormones).
- c) Endocrine glands:
- (i) Pituitary gland: Location, anatomy and functions of hormones with hypothalamic regulation.
- (ii) Thyroid gland: Location, anatomy, synthesis and function of T_3 & T_4 .

Unit - V

- a) Physiology of Excretion: Nitrogenous wastes, anatomy of mammalian, structure of nephron, mechanism of urea and urine formation (including hormonal regulation).
- b) Osmoregulation.
- c. Physiology of Reproduction: (i) Hormonal control of male and female reproduction, implantation, parturition and lactation in mammals, (ii) Reproductive cycles

References:

- Animal Physiology by A. Maria Kuttikan & N. Arumugam - (Saras Publication, Nagercoil, Tamil Nadu).
- Animal Physiology and biochemistry by K.V. Sastry - (Rastogi Publications, 2008).
- Regulatory mechanism in Vertebrates by Kamleshwar Pandey and J.P. Shukla - (Rastogi Publications, 2008).
- Animal Physiology by K.A. Goyal and K.V. Sastry - (Rastogi Publications, 2008).
- Endocrinology and Reproductive Biology by K.V. Sastry - (Rastogi Publications, 2008).
- Animal physiology by Arora M.P. (1989) - himalaya Publishing House.
- Textbook of mecial Physiology by Guyton A.C. & Hall J.E. (1996) - (W.B. Saunders & Co.)
- General and Comparative Physiology by Hoar W.S. (1983) - (Prentice Hall Publication).
- A textbook of Animal Physiology by Hurtkat P.C. & Mathur P.N. (1976) - (S.Chand & Co.)
- General Endocrinology by Turner C.D. & Gangara J.T. (1971) - (W.B. Saunders & Co.)

PAPER III COMPARATIVE ANATOMY, ANIMAL BEHAVIOUR AND ECONOMIC ZOOLOGY

Duration : 3 Hours**Max. Marks : 50**

Note ; In this question paper Ten questions will be set two questions from each unit. Candidates have to answer five questions taking one question from each unit.

Unit - I

Comparative anatomy of vertebrates from an evolutionary point of view of the followings:

- a) Integument including structure and development of placoid scales, feathers and hair.
- b) Heart and aortic arches
- c) Kidney and associated urinogenital ducts.

Unit - II

- a) Introduction and history of Ethology.
- b) Behaviour: Innate behaviour - (tropism, taxis, reflexes & instincts) and Acquired behaviour (Learning and reasoning).
- c) Motion: Classification of directional movements - Kinesis, tropism and Taxis.

Unit - III

- a) Communication: Definition, types of signals (touch, sound, chemical and visual), metacommunication.
- b) Pheromones: Definition, types, origin, role in behaviour, pheromones in social insects.
- c) Societies: Characteristics and advantages with special reference to honey bee, deer and monkey.

Unit - IV

- a. Apiculture
- b. Lac culture
- c. Seri culture

Unit - V

- a) Pearl culture
- b) Fish culture
- c) Insects as pests and their management.

PRACTICALS**Duration 4 hours****Max. Marks :50****Min. for Pass: 18****Objectives:**

To develop in the students the skills of staining and mounting of materials (temporary and permanent); of dissection, display and labeling; of collection, preservation, mounting, identification and labeling of collected specimens; of field observation of animals. To enable students to develop the skills of hematology and endocrinology.

Course Content

- 1) Study of Museum specimens:
- (a) Hemichordata: Balanoglossus
- (a) Urochordata: Herdmania, Pyrosoma,
- (b) Cephalochordata: Amphioxus Lanceolatum
- (c) Cyclostomata: Petromyzon, Myxine
- (d) Pisces: Scoliodon, Sphyrna, Torpedo, Pristis, Trygon, Lepidosteus, Labeo, Clarias, Ophiocephalus, Anabas, Exocoetus, Hippocampus,

Tetradon, Protopterus.

- (e) Amphibia: Ichthyophis, Necturus, Proteus, Ambystoma, Axototal larva, Triturus, Amphiuma, Alytes, Bufo.
- (f) Reptilia: Testudo, Trionyx, Sphenodon, Hemidactylus, Draco, Calotes, Chamaeleon, Varanus, Heloderma, Typhlops, Eryx, Hydrophis, Viper, Bungarus, Naja, Alligator, Gavialis.
- (g) Aves: Pavo, Columba, Psitacula, Passer, Corvus, Archaeopteryx.
- (h) Mammals: Ornithorhynchus, Echidna, Macropus, Loris, Manis, Rattus.
2. Study of Permanent Slides:
- (a) Balanoglossus: T.S. of proboscis, collar region and trunk.
- (a) Amphioxus: T.S. of oral hood, pharynx,
- (b) Mammals: T.S. skin, Stomach, Duodenum, Ileum, liver, Pancreas, spleen, lung, kidney, Testis, Ovary.
3. Osteology:
- (a) Study of skull bones of Frog, bird and Rabbit.
- (b) Study of vertebral of Frog, Rabbit, bird and Rabbit.
- (c) Study of girdles, forelimb and hind limb bones of Frog, Rabbit, bird and rabbit.
4. Dissect and display the following:
- (a) Scoliodon: Afferent branchial system, efferent branchial system, cranial nerves (V, VII & IX, X) and internal ear.
5. Permanent/Temporary preparations of the following:
- (a) Scales: Placoid, Cycloid
- (b) Blood film of any vertebrate
- (c) Filoplumes of birds
- (d) Thigh muscles of frog.
6. Estimation of Hemoglobin.
7. Enumeration of RBC in blood samples.
8. Enumeration of WBC in blood samples.
9. Preparation of Haemin Crystals.
10. Effect of different concentrations of NaCl on RBC.
11. Measurement of blood pressure, Heart beat and Pulse rate.
12. Study of bleeding time, Coagulation of time of blood.
13. Demonstration of heart beat in Frog – Preparation of simple cardiogram, effect of various chemicals on heart beat.
14. Study of Historical slides of the following endocrine glands of mammal: Testes, ovary, thyroid, adrenal, pituitary, Islets of Langerhans.
15. Dissect and display endocrine glands of cockroach.

4. BOTANY

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	50	54
Paper II	3 hours	50	
Paper III	3 hours	50	
Practical	4 hours	50	18

PAPER – 1: DIVERSITY OF SEED PLANTS

Duration: 3 hours

Max. Mark – 50

Note – There will be ten questions in all, two from each unit. Students have to answer any five questions selecting one from each unit.

Unit – I

Characteristics of seed plants; evolution of the seed habit; seed plants with fruits (angiosperms) and without fruits (gymnosperms); fossil and living seed plants; geological time scale, fossilization and fossil gymnosperms.

Unit – II

Angiosperms: Origin and evolution; primitive angiosperms. diversity in plant forms-annuals, biennials and perennials; convergence of evolution of tree habit in gymnosperms, monocotyledons and dicotyledons, trees-largest and longest lived organisms?

Unit – III

General features of gymnosperms and their classification; morphology and anatomy of vegetative and reproductive parts; life cycle of *Cycas*.

Unit – IV

Morphology and anatomy of vegetative and reproductive parts and life cycle of *Pinus* and *Ephedra*.

Unit – V

Significance of seed – suspended animation; ecological adaptation; unit of genetic recombination and replenishment; dispersal strategies. Vegetative reproduction, grafting, and economic aspects.

Suggested Readings

- Bhatnagar, A.P. and Moitra, A. 1996. Gymnosperms. New Age International Limited, New Delhi.
- Gifford, E.M. and Foster, A.S. 1988. Morphology and Evolution of Vascular Plants. W. H. Freeman & Company, New York.
- Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co. (Publishers) Ltd., London.
- Stewart, W. M. 1983. Paleobotany and the Evolution of Plants. Cambridge University Press. Cambridge.

PAPER – II: SYSTEMATICS OF ANGIOSPERMS**Duration : 3 hours.****Max. Marks : 50**

Note – The paper is divided in five independent units. Two questions will be set from each unit. Candidates are required to attempt one question from each unit.

Unit – I

Angiosperm taxonomy: Brief history, aims and fundamental concepts of artificial, natural and phylogenetic system of classification, Bentham & Hooker, Cronquist and Takhtajan' system of classification. Herbarium technique, important herbaria and botanical gardens of India.

Unit – II

Botanical Nomenclature: Principles and rules, ICBN, type concept, units of classification, principle of priority, identification keys, floras.

Unit – III

Diversity of flowering plants as illustrated by members of the families – Annonaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae (Faboideae, Caesalpinoideae, Mimosoideae) Apiaceae.

Unit – IV

Diversity of Flowering plants as illustrated by members of the families – Acanthaceae, Apocynaceae, Asclepiadaceae, Asteraceae, Solanaceae, Lamiaceae.

Unit – V

Diversity of flowering plants as illustrated by members of the families – Amaranthaceae, Euphorbiaceae, Liliaceae, Poaceae.

Suggested Readings

- Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
 Heywood, V.H. and Moore, D.M. (eds) 1984. Current Concepts in Plant Taxonomy. Academic Press. London.
 Jaffrey, C, 1982. an Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
 Jones, S.B., Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). Mc Graw-Hill Book Co., New York.
 Maheshwari, J.K. 1963. Flora of Delhi, CSIR, New Delhi.
 Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row, New York.
 Singh, F. 1999. Plant Systematics: theory and Practice. Oxford and IBH Pvt. Ltd., New Delhi.
 State, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition). Edward Arnold, London.

PAPER – III: CELL BIOLOGY AND GENETICS**Duration : 3 hours.****Max. Marks : 50**

Note – The paper is divided into five independent units. Two questions will be set from each unit. Candidates are required to attempt one question from each unit.

Unit – I

Ultrastructure of cell and cell organelles; Plasma membrane, Cell wall, Golgi Complex, endoplasmic reticulum, peroxisomes, vacuoles, mitochondria, chloroplast, nucleus.

Unit – II

Chromosome organization; Morphology, centromere and telomere; chromosome alterations – deletions, duplication, inversions and translocations; Variations in chromosome number – aneuploidy, euploidy, sex chromosomes.

Cell division; Mitosis and meiosis.

Unit – III

Nuclear and extra nuclear genetic material: DNA structure; replication; DNA protein interaction; nucleosome model; genetic code; satellite and repetitive DNA; mitochondrial and plastid DNA; plasmid; gene mapping

Unit – IV

Gene expression: Structure of gene; transfer of genetic information; proteins, structure and classification; transcription; translation; tRNA, ribosomes; regulation of gene expression in prokaryotes and eukaryotes.

Unit – V

Genetic inheritance: Mendelism, Laws of segregation and independent assortment, Linkage analysis; allelic and non-allelic interactions. Genetic variations: Mutations, spontaneous and induced; transposable genetic elements; DNA damage and repair.

Suggested readings

- Alberts, B., Bray, D., J., Raff, M., Roberts, K and Watson, I. D. 2001. Molecular Biology of Cell Garland, publishing Co. Inc., New York, USA.
 Atherey, G., Girton, J. R. and McDonald, J. F. 1999. The Science of Genetics Saunders College Publishing, Fort Worth, USA.
 Gupta, P.K. 1999. A Textbook of Cell and Molecular Biology. Rastogi Publications, Meerut.
 Kleinsmith, L. J. and Kish. V.M. 1995, Principles of Cell and Molecular Biology (3rd edition). Harper Collins College Publishers, New York, USA.
 Lodish, H., Berk, A., Aipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology. W.H. Freeman & Co. New York, USA.
 Russel, P. J. 1998. enetics. The Benjamin/Cummings Publishing Co. Inc., USA.
 Snustad, D.P. and Simmons, M. J. 2000. Principles of Genetics. John Wiley & Sons, Inc., USA.
 Stent, G.S. 1986. Molecular Genetics. CBS Publications, Delhi.
 Wolfe, S.L. 1993. Molecular and Cell Biology. Wodsworth Publishing Co., California, USA.

PRACTICALS**Duration: 4 hrs****Gymnosperms:****1. Cycas****Max. Marks: 50**

Habit, armour of leaf bases on the stem, very young leaf (circinate vernation) and old foliage leaves, scale leaf, bulbils, male cone, microsporophyll, megasporophyll, and mature seed.

Study through temporary micro preparations or permanent slides – normal root, coralloid root, stem, rachis, leaflet, microsporophyll, pollen grains, and ovule.

2. Pinus

Habit, long and dwarf shoot showing cataphylls and scale leaves, T.S. wood showing growth rings, male cones, female cones, and winged seeds.

Study through temporary micro preparations and/or permanent slides – stem (young and old), needle, pollen grains, root, female cone, ovule embryo (W.M.) showing polycotyledonous condition.

3. Ephedra

Habit and structure of whole male and female cones.

Temporary micro preparations and/or permanent slides of node, internode, macerated stem to see vessel structure; epidermal peel mount of vegetative parts to study stomata, male cone, female cone, and pollen grains.

4. Angiosperms

Familiarity with the terms used in technical description of plants. Study of representative plants of families included in the syllabus.

5. Cyto-genetics

1. Study of cell structure from onion leaf peels; demonstration of staining and mounting methods.
2. Comparative study of cell structure in onion cells, *Hydrilla* and *Spirogyra*. Study of cyclosis in *Tradescantia*, staminal hairs.
3. Study of plastids to examine pigment distribution in plants (e.g., *Cassa*, *Lycopersicon* and *Capsicum*).
4. Examination of electron micrographs of eukaryotic cells with special reference to organelles.
5. Study of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organization.
6. Examination of various stages of mitosis and meiosis using appropriate plant material (e.g. onion root tips, onion flower buds).
7. Preparation of karyotypes from dividing root tip cells and pollen grains.
8. Cytological examination of special types of chromosomes: bar body, lamp brush and polytene chromosomes.
9. Working out the laws of inheritance using seed mixtures.
10. Working out the mode of inheritance of linked genes from testcross and or F2 data.

Suggested Readings

- Fukui, K. and Nakayama, S. 1996. Plant Chromosomes: Laboratory Methods. CRC Press, Boca Raton, Florida.
Gunning, B.E.S. and Steer, M. W. 1996. Plant Cell Biology: Structure and Function. Jones and Barlett Publishers. Boston Massachusetts.

Harris, N. and Oparka, K. J. 1996. Plant Biology: A Practical Approach. IRL Press at Oxford University Press. Oxford, UK.

Sharma A.K. and Sharma A. 1999, Plant Chromosomes: Analysis. Manipulation and Engineering. Harwood. Academic Publishers Australia.

5. MATHEMATICS

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	70	72
Paper II	3 hours	65	
Paper III	3 hours	65	

PAPER I : ALGEBRA

Duration : 3 hrs.

Max. Marks : 70

Note: In this question paper ten questions will be set, two questions from each unit. Candidates have to answer five questions taking one question from each unit.

Unit I

Symmetric, Skew symmetric, Hermitian and Skew Hermitian matrices, Linear independence of rows and column matrices, Row rank, Column rank and rank of a matrix, Equivalence of column and row ranks, Eigen values, Eigen vectors and the characteristic equation of a matrix, Cayley's theorem and its use in finding the inverse of a matrix.

Unit II

Applications of matrices to a system of linear homogeneous and non homogeneous equations, Theorems on consistency of a system of linear equations, Relations between the roots and coefficients of general polynomial equations in one variable, transformation of equations, Descarte's rule of signs, solution of cubic equations (Cardon method).

Unit III

Definition and examples of Groups, General properties of Groups, Sub Groups, Cyclic groups, cosets, Lagrange's theorem, Fermat's and Euler's theorems, Homomorphism and Isomorphism, Normal subgroups, Quotient groups.

Unit IV

The fundamental theorem of homomorphism, Permutations, Groups, Even and odd permutation, Cayley's theorem.

Unit V

Introduction to Rings, Sub rings, Integral Domains and Fields, Boolean Algebra.

PAPER II : REAL ANALYSIS

Duration : 3 hours.

Max. Marks : 65

Note: In this question paper ten questions will be set, two questions from each unit. Candidates have to answer five questions taking one question from each unit.

Unit I

Limit, Definition of the limit of a function, Basic properties of the limits, Continuous functions and classification of discontinuities, Sequential continuity, Properties of continuous functions, Uniform continuity, Limit and continuity of functions of two variables.

Unit II

Differentiability, Chain rule of differentiability, Mean Value Theorems and their geometrical interpretations, Darboux's intermediate value theorem for derivatives, Taylor's theorem with various forms of remainders, Taylor's theorem for functions of two variables.

Unit III

Riemann integral, Integrability of continuous and monotonic functions, The fundamental theorem of integral calculus, Mean value theorems of integral calculus.

Unit IV

Real sequence, Definition, Theorems on limits of sequences, Bounded and monotonic sequences, Cauchy's convergence criterion, Infinite Series of non negative terms, Comparison tests, Cauchy's integral test, Ratio tests, Raabe's logarithmic, De Morgan and Bertrand's tests, Alternating series, Leibnit'z theorem, Absolute and conditional convergence.

Unit V

Uniform convergence of series of functions, Weirestrass M-test, Abel's and Dirichlet's test for uniform convergence. Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests, Fourier expansion of piecewise monotonic functions.

PAPER III : DIFFERENTIAL EQUATIONS

Duration : 3 hours.

Max. Marks : 65

Note: In this question paper ten questions will be set, two questions from each unit. Candidates have to answer five questions taking one question from each unit.

Unit I

Linear differential equations with constant coefficients, Homogeneous Linear Ordinary differential equations, Ordinary simultaneous differential equations, Total differential equations.

Unit II

Linear differential equations of second order, Transformation of the equation by changing dependent variable/the independent, variable Methods of variation of parameters.

Unit III

Series solution of differential equations, Power series method, Bessel, Legendre and Hypergeometric equations, Bessel, Legendre and Hypergeometric functions and their properties.

Unit IV

Partial Differential Equations of the first order, Lagrange's solution, Some

special type of equations which can be solved easily by methods other than the general method, Charpit's general method of solution.

Unit V

Partial Differential equations of second order and higher orders, Classification of linear partial differential equations of second order, homogeneous and non homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Monge's methods.

6. PSYCHOLOGY OF LEARNER, LEARNING AND INSTRUCTION

Duration : 3 hours

Max. Marks 75 Min. Marks for Pass: 27

Note: ten questions will be set in all, two questions from each unit. Candidates have to answer five questions taking one question from each unit.

Objectives:

- On completion of the course the student teacher will be able to understand the basic concepts, methods and principles of Psychology.
- appreciate the development tasks with special reference to adolescent learners.
- know the process of learning in the context of various theories and their implication for classroom teaching.
- understand intelligence, motivation and various types of children with special needs.
- appreciate effective teaching learning process

UNIT I: Nature of Educational Psychology and Learner

- **Educational Psychology:** Its meaning, nature and scope. Educational Psychology as a field of study: Meaning, Methods of Study Case Study, Survey and Experimental, Implication for Curriculum development, instructional and learning.
- **Growth and Development:** Meaning and Principles, Stages of human development, Stage specific characteristics of learners, Physical, Cognitive, Social emotional and Moral developments during Adolescence.
- **Guidance and counseling:** Concept, Techniques, Personal and Group Guidance, Educational and Vocational Guidance with reference adolescence.

UNIT II: Individual differences

- **Individual differences:** Heredity and Environment, Problems of adolescence, their need and aspiration.
- **Nature of intelligence and its development –** Theories of intelligence Multifactor Theory and SI Model . Measurement of Intelligence, Verbal, non-verbal and performance tests.
- **Concept of children with special Needs:** Inclusive Education, Types, Characteristics, identification and functional limitation of : visual impairment, Hearing impairment, locomotor impairment, mental

retardation, learning disability and Gifted children.

UNIT III: Learning and Motivation

- **Nature of learning:** Learning theories – Behaviourists (skinner's operant conditioning), Information processing (Rogers) and Humanistic (Maslow's), Constructivism.
- **Factors influencing learning and teaching process:** learner related, teacher related, process related and content related. Transfer of learning.
- **Motivation :** nature, type and techniques of enhancing learners' motivation.

UNIT IV: Personality

- **Personality:** Definition, Meaning, nature, factors important for shaping personality of learners.
- **Types and Trait theories of Personality:** Personality differences, introversion – Extroversion, Development of Personality.
- **Assessment of Personality:** Different techniques

UNIT V: Adjustment

- **Concept of mental health and personality factors influencing mental health, Concept of social adjustment, Social Adjustment and interpersonal relationship.**
- **Group Dynamics and Teacher's role. Violence in schools, symptoms of violence and aggression.**
- **Punishment and Correcture behaviour.**
- **Reflective thinking and Inner peace.**
- **Role of guidance and counselling for reducing maladjustment and improving mental health.**
- **Practicum:**

Any three of the following:

Observing the behaviour of adolescent and describing his/her characteristics and problems.

A case study of a child with special need suggesting remedial measures.

Administering and interpreting the result of one test of intelligence (verbal, non-verbal or performance)

Administering and interpreting the result of one test of personality.

Reference:

Bigge, M.L. and Hunt, M.P. 1962. Psychology Foundations of Education, New York: Harper and brothers.

Ellot, J.(Holt, Rinehart and Winston) 1971. Human Development and Cognitive Processes.

Meferkland, (Routledge and Kegan Paul) 1971. Psychological Theory and Educational Practice, London:

Hurlock, E.B.(McGraw Hill Kagakusta Ld.) 1978. 6th Ed. of Child Development, Tokyo:

Klausmen, H.J. (Harper and Row and John weather Hill) 1964. Learning and Human Abilities Educational Psychology, Tokyo:

Dunn, M.L. (Holt, Rinehart and Winston) 1963. Exceptional Children in the Schools.

Samual, A.K. 1962. Educating Exceptional Children, New Delhi: Oxford & IBH Publishing Co.

Deccecco, J.P. 1970. Psychology of Learning and Instruction: Educational Psychology, New Delhi: Prentice Hall of India Ltd.

Hills, P.J. (Crom Helm) 1986. New Patterns of Learning: Teaching Learning and Communications, London:

Gagne, R.M. (Holt, Rinehart and Winston) 1965. The Conditions of Learning

Bower, G.H. and Hilgard, E.R. 1986. Theories of Learning, New Delhi: Prentice Hall of India.

Arun Malamah, Thomas. 1988. Classroom Interaction Oxford University Press.

Janet Moyles, 1995. Beginning Teaching: Beginning Learning in Primary Education, Open University Press.

Michael W. Eysenck, 1993. Principle of Cognitive Psychology, USA: Lawrence Erlbourn Association.

7. WORK EXPERIENCE: ELECTRICITY

Duration: 3 hours

Max. Marks: 50

Min. for pass: 18

(Internal Examination)

Unit 1

Knowledge of electronic components such as resistors and capacitors, their specification, various parameters, construction and their colour coding. Colour coding and symbols of electronics.

Unit II

Knowledge of different soldering methods like hand soldering, wave soldering, dip soldering and ultra sonic soldering. Soldering alloy, soldering flux and desoldering pump. Practice of hand soldering.

Unit III

Construction and characteristics of diode, Transistor – Recognition of base, emitter and collector terminal of a transistor and its characteristics.

FET – Recognition of drain, source and gate terminal of a FET and its characteristics. Wiring of a given circuit and testing of simple one, two transistor/FET.

Unit IV

Construction of transformers, Recognition of primary and secondary winding. Knowledge of step up and step down transformer. Use of transformers

Unit V

Construction and working of display devices like LED, LCD and seven segment display. Knowledge of testing Board and Extension Boards for labs making use of Resistance/capacitor boxes.

WORK EXPERIENCE: AGRICULTURE

Duration: 3 hours

Max. Marks: 50
 Min. for pass: 18
 (Internal Examination)

Unit 1**Identification of the followings:**

- Seeds of common crops.
- Seeds of common vegetables.
- Important weeds.
- Manures commonly used.
- Fertilizers commonly used.

Unit II**Seeds and Seedlings:**

- Characteristics of a good seed for sowing.
- Calculation of germination percentage of seeds.
- Planting seeds and transplanting seedlings.
- Raising seedlings in a nursery.
- Study about green-house.

Unit III**Ornamental gardening:**

- Identification of different summer flowers
- Identification of different winter flowers
- Identification of common hedge and creeper plants
- Preparation and maintenance of rockeries and borders
- Preparation and maintenance of borders through hedge & flower plantation

Unit IV**Horticultural practices:**

- Agro-forestry and related concepts
- Potting and repotting practices
- Practices related to production of important flowering plants.
- Collection of different types seeds.
- Preparation of a project.

Unit V**General field practices:**

- Earthing
- Planting
- Hoeing
- Weeding
- Watering of plants

SCHEME OF B.SC.B.ED. PART-III EXAMINATION**1. PHYSICS**

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	50	36
Paper II	3 hours	50	
Practical	5 hours	50	18

Note: ten questions will be set in all, two questions from each unit. Candidates have to answer five questions taking one question from each unit.

PAPER – I: SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS

Duration: 3 hrs
 Solid State Physics

Max. Marks: 50

Unit I

Overview: Crystalline and glassy forms, liquid crystals, glass transition
 Structure: Crystal structure; periodicity, lattices and bases, fundamental translation vectors, unit cell, Wigner-seitz cell, allowed rotations, lattice types, lattice planes, common crystal structures.

Laue's theory of X-ray diffraction, Bragg's law, Laue patterns.

Bonding: Potential between a pair of atoms; Lennard-Jones potential, concept of cohesive energy, covalent, Van der Waals, ionic, and metallic crystals.

Magnetism: Atomic magnetic moment, magnetic susceptibility, Dia-Para- and Ferromagnetism, Ferromagnetic domains, hysteresis.

Unit-II

Thermal properties: lattice vibrations, simple harmonic oscillator, second order expansion of Lennard-Jones potential about the minimum, vibrations of one dimensional monatomic chain under harmonic and nearest neighbour interaction approximation, concept of phonons, density of modes (1-D). Debye model; lattice specific heat, low temperature limit, extension (conceptual) to 3-D.

Band structure: Electrons in periodic potential; nearly free electron model (qualitative), energy bands, energy gap; metals, insulators, semiconductors.

Motion of electrons: Free electrons, conduction electrons, electron collisions, mean free path, conductivity and Ohm's law. Density of states, Fermi energy, Fermi velocity, Fermi-Dirac distribution.

Unit III

Semiconductors: Intrinsic semiconductors, electrons and holes, Fermi level. Temperature dependence of electron and hole concentrations. Doping; impurity states, n and p type semiconductors, conductivity,

mobility, Hall effect, Hall coefficient.

Semiconductor devices: metal-semiconductor junction, p-n junction, majority and minority carriers, diode, Zener and tunnel diodes, light emitting diode, transistor, solar cell.

Electronics

Unit IV

Power supply: Diode as a circuit element, load line concept, rectification, ripple factor, Zener diode, voltage stabilization, IC voltage regulation, characteristics of a transistor in CB, CE and CC mode, graphical analysis of the CE configuration, low frequency equivalent circuits, h-parameters, bias stability, thermal runaway.

Field effect transistors: JFET volt-ampere curves, biasing JFET, as operation of JFET, source follower, depletion and enhancement mode, MOSFET, biasing MOSFET, FET as variable voltage resistor, digital MOSFET circuits. Tunnel diode, concept of negative resistance, characteristics and working. UJT its construction and working. UJT as relaxation oscillator.

Unit V

Small signal amplifiers: General principles of operation, classification, distortion, RC coupled amplifier, gain frequency response, input and output impedance, multistage amplifiers, transformer coupled amplifiers, Equivalent circuits at low, medium and high frequencies; emitter follower, low frequency common-source and common-drain amplifier, Noise in electronic circuits.

Text and Reference Books

1. C.Kittel; Introduction to Solid State Physics, Vth Edition (John Wiley and Sons, New York, 1976)
2. S Blackmore; Solid state Physics, IInd Edition (Cambridge University press, Cambridge)
3. N W Ashcroft and N D Mermin; Solid State Physics (Holt, Rinehart and Winston, New York, 1976)
4. B G Streetman; Solid State Electronic devices, IInd Edition (Prentice-Hall of India, New Delhi, 1986)
5. W D Stanley; Electronic Devices, Circuits and Applications, (Prentice-Hall, New Jersey, USA, 1988)
6. J D Ryder; Electronics Fundamentals and Applications, IInd Edition (Prentice-Hall of India, New Delhi, 1986)
7. J Millman and A Grabel; Microelectronics, International Edition (McGraw-Hill Book Company, New York, 1988).

PAPER II : WAVES AND ACOUSTICS AND STATISTICAL PHYSICS

Duration: 3 hrs

Max. Marks: 50

Note: ten questions will be set in all, two questions from each unit. Candidates

have to answer five questions taking one question from each unit.

Waves

Unit I

Waves in media: Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements. Waves over liquid surface: gravity waves and ripples. Group velocity and phase velocity, their measurements.

Superposition of waves: Linear homogeneous equations and the superposition principle, nonlinear superposition and consequences.

Standing waves: Standing waves as normal modes of bounded systems, examples, Harmonics and the quality of sound: examples. Chladni's figures and vibrations of a drum.

Acoustics

Unit II

Noise and Music: The human ear and its responses: limits of human audibility, intensity and loudness, bel and decibel, the musical scale, temperament and musical instruments. Production and detection of ultrasonic and infrasonic waves and applications.

Applied acoustics: Transducers and their characteristics. Recording and reproduction of sounds, various systems, Measurements of frequency, waveform, intensity and velocity. The acoustics of halls, reverberation period, Sabine's formula.

Unit III

Reflection, refraction and diffraction of sound: acoustic impedance of a medium, percentage reflection and refraction at a boundary, impedance matching for transducers, diffraction of sound, principle of a sonar system, sound ranging.

Unit IV

Statistical Physics

The statistical basis of thermodynamics: Probability and thermodynamic probability, principle of equal a priori probabilities, probability distribution and its narrowing with increase in number of particles. The expressions for average properties. Constraints, accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states.

Some universal laws: The mu space representation, division of mu space into energy sheets and into phase cells of arbitrary size, application to one-dimensional harmonic oscillator and free particles. Equilibrium before two systems in thermal contact, bridge with macroscopic physics. Probability and entropy, Boltzmann entropy relation. Statistical interpretation of second law of thermodynamics. Boltzmann canonical distribution law and its applications; rigorous form of equipartition of energy.

Unit V

Maxwellian distribution of speeds in an ideal gas: Distribution of speeds and of velocities, experimental verification, distinction between mean, rms and most probable speed values. Doppler broadening of spectral lines.

Transition to quantum statistics: 'h' as a natural constant and its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator. Indistinguishability of particles and its consequences, Bose-Einstein, and Fermi-Dirac conditions; applications to liquid helium, free electrons in a metal, and photons in blackbody chamber. Fermi level and Fermi energy.

Text and Reference Books

1. B B Laud, Introduction of Statistical Mechanics (Macmillan 9181).
2. F Reif: Statistical Physics (Mcgraw-Hill, 1988).
3. K Haug: Statistical Physics (Wiley Eastern, 1988).
4. Berkely Physics Course; Vol. III Waves and Oscillations
5. I G Main; Vibrations and Waves (Cambridge University Press)
6. H J Pain; The Physics of Vibrations and Waves (MacMillan 1975)

PRACTICALS**Duration: 5 hours****Max. Marks: 50****Min for Pass: 18**

Any twelve of the following experiments are to be performed.

- (1) Study of a R.C. Transmission line at 50 Hz.
- (2) Study of a L.C. transmission line
 - (i) a fixed frequency (ii) at variable frequency
- (3) (i) Study the Recovery time as a function of frequency of operation and switching current.
 - (ii) Recovery time of junction diode and point contact diode.
- (4) Design and Study of a Zener/VR tube regulated power supply and study the regulation with various load.
- (5) Study the characteristics of a field effect transistor (FET) and design and study of amplifier of finite gain.
- (6) Study the characteristics of a uni junction transistor.
- (7) Study the frequency responses of a transistor amplifier (bipolar/FET) obtain the input and output impedance of the amplifier.
- (8) Design and study of an R-C phase shift oscillator and to measure output impedance (frequency response with change of component of value R & C).
- (9) To study the characteristics of a thermistor.
- (10) Direct measurement of magnetic field by PSSC Method.
- (11) To find the mass of electron by magic eye tube (PSSC) method.
- (12) Study of the Hybrid parameters of a transistor.

- (13) Study of negative feedback amplifier. (Frequency response & bandwidth 2 distortion)

Laboratory tutorials

1. Find roots of $f(x) = 0$ by using Newton-Raphson method
2. Find roots of $f(x) = 0$ by using secant method
3. Integration by Simpson rule
4. To find the value of y at a given value of x by Runge-Kutta Method
5. Eight Queens Problem
6. String manipulations
7. Towers of Hanoi (Nonrecursive)
8. Finding first four perfect numbers

2. CHEMISTRY

Scheme	Exam. Duration	Period/ week	Max. Marks for Pass	Min.
Paper I Organic Chemistry	3 hrs.	3	50	} 36
Paper II Physical Chemistry	3 hrs.	3	50	
Practicals	5 hrs	4	50	18

PAPER – I - ORGANIC CHEMISTRY**Duration : 3 hours****Max. Marks : 50**

Note – The paper is divided in five independent units. Two questions will be set from each unit. Candidates are required to attempt one question from each unit.

Unit – I**Electromagnetic Spectrum: Absorption Spectra**

Ultraviolet (UV) absorption spectroscopy – absorption laws (Beer Lambert law), molar absorptivity, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Woodward Fieser rules for calculation of absorption maxima in dienes and α, β unsaturated carbonyl compound for Infrared (IR) absorption spectroscopy – molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, fingerprint region characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

Unit – II**(a) Alcohols**

classification and nomenclature.

Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.

Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage $[Pb(OAc)_2]$ and HIO_4 and

pinacol-pinacolone rearrangement. Trihydric alcohols-nomenclature and methods of formation, chemical reactions of glycerol.

(b) Phenols

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Acidic strengths of alcohols and phenols. resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

Unit - III**(a) Ethers and Epoxides**

Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions - cleavage and auto oxidation, Ziesel's method.

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and Organolithium reagents with epoxides.

(b) Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

Methods of formation and chemical reactions of unsaturated monocarboxylic acids.

Dicarboxylic acids: Methods of formation and effect of heat and dehydrating agents.

(c) Carboxylic Acid Derivatives

Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides.

Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Preparation of carboxylic acid derivatives, chemical reactions, mechanisms of esterification and hydrolysis (acidic and basic).

Unit - IV**Aldehydes and Ketones**

Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3-dithianes. ~~synthesis of ketones~~ synthesis of ketones from nitriles and from carboxylic acid. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knoevenagel condensations.

Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes. Baeyer-villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen. Wolff-kishner, LiAlH_4 and NaBH_4 reductions, Halogenation of enolizable ketones.

Introduction to α , β unsaturated aldehydes and ketones.

Unit - V**Organic Compounds of Nitrogen**

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes.

Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid. Halonitroarenes: Reactivity.

Structure and nomenclature of amines, physical properties. Stereochemistry of amines, Separation of a mixture of primary, secondary and tertiary amines, Structural features effecting basicity of amines. Amines salts as phase-transfer catalysts, Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction, Hofmann bromamide reaction.

Reactions of amines: Electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.

PAPER - II - PHYSICAL CHEMISTRY

Duration : 3 hrs.

Max. Marks: 50

Note - The paper is divided in five independent units. Two questions will be set from each unit. Candidates are required to attempt one question from each unit.

Unit - I**Elementary Quantum Mechanics**

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. De Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator. Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

Unit - II**Molecular Orbital Theory**

Basic ideas-criteria for forming M.O from A.O, construction of M.O's by LCAO- H_2^+ ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ , σ^* , π , π^* orbitals and their characteristics. Hybrid orbitals - sp , sp^2 , sp^3 , calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H_2 , comparison of M.O. and V.B. models.

Unit - III

(a) Spectroscopy

Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom,

(b) Rotational Spectrum

Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

(c) Vibrational Spectrum

Infrared spectrum: energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman Spectrum: concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules σ , π - and n M.O., their energy levels and the respective transitions.

Unit - IV

(a) Electric-Spectrum

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank-Condon principles.

Qualitative description of σ , π - and n M.O., their energy levels and the respective transitions.

(b) Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes. Law of photochemistry: Grothus - drapper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions - energy transfer processes (simple examples).

Unit - V

(a) Physical Properties and Molecular Structure

Optical activity, polarization - (Clausius - Mossotti equation), orientation

of dipoles in an electric field, dipole, moment, induced dipole moment, measurement of dipole moment temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties-paramagnetism, diamagnetism and ferromagnetics.

(b) Solutions, Dilute Solutions and Colligative Properties

Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and coefficient.

Dilute solutions, colligative properties, Raoult's law relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point. Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

PRACTICAL

Duration: 5 hrs

Max. Marks: 50

INORGANIC CHEMISTRY

Synthesis and analysis

- Preparation of sodium trioxalato ferrate (III), $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permanganometry.
- Preparation of Ni-DMG complex, $[Ni(DMG)_2]$
- Preparation of copper tetraammine complex. $[Cu(NH_3)_4]SO_4$.
- Preparation of cis- and trans - bisoxalatodiaqua chromate (III) ion.

GRAVIMETRIC ANALYSIS

Analysis of Cu as $CuSCN$ and Ni as Ni (dimethylglyoxime).

Synthesis of Organic Compounds

- Acetylation of salicylic acid, aniline, glucose and hydroquinone.
 - Benzoylation of aniline and phenol.
 - Aliphatic electrophilic substitution
Preparation of iodoform from ethanol and acetone
- (c) Aromatic electrophilic substitution
- Nitration
- Preparation of m-dinitrobenzene
 - Preparation of p-nitroacetanilide
- Halogenation
- Preparation of p-bromoacetanilide
 - Preparation of 2,4,6-tribromophenol
- Diazotization/coupling
Preparation of methyl orange and methyl red
 - Oxidation
Preparation of benzoic acid from toluene
 - Reduction

Preparation of aniline from nitrobenzene

Preparation of m-nitroaniline from m-dinitrobenzene.

PHYSICAL CHEMISTRY

Electrochemistry

To determine the strength of the given acid conductometrically using standard alkali solution.

To determine the solubility and solubility product of a sparingly solubility product of a sparingly soluble electrolyte conductometrically.

To study the saponification of ethyl acetate kinetically.

To determine the ionization constant of a weak acid conductometrically.

To titrate potentiometrically the given ferrous ammonium sulphate solution using $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ as titrant and calculate the redox potential of $\text{Fe}^{++}/\text{Fe}^{+++}$ system on the hydrogen scale.

3. ZOOLOGY

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	50	36
Paper II	3 hours	50	
Practical	4 hours	50	18

PAPER I: DEVELOPMENTAL BIOLOGY

Duration: 3 hours

Max. Marks: 50

Objectives:

To enable students to comprehend the modern concepts of developmental biology; to understand the developmental sequences in vertebrates; to compare the development of organs and systems.

Note: Ten questions will be set, two from each unit. Candidates are required to answer five questions selecting one from each unit.

Unit I

- Gametogenesis: i) Structure and types of spermatozoa, spermatogenesis. ii) Structure and types of eggs, oogenesis.
- Fertilization: Types, mechanism and significance.
- Cleavage: Characters, types, patterns and products of cleavage, fate map.

Unit II

- Gastrulation: Morphogenetic movements and significance.
- Embryogenesis of amphioxus: Development up to the end of neurulation and tubulation.
- Embryogenesis of frog: Development up to the end of neurulation and tubulation.
- Metamorphosis of tadpole larva.

Unit III

- Embryogenesis of chick: Development up to neurulation, tubulation and enterogenesis.

- Development of chick according to the hours of incubation – 18 hours, 21 hours, 24 hours, 33 hours, 56 hours, 48 hours, 72 hours and 96 hours.
- Extra embryonic membranes of chick – development and functions.

Unit IV

- Placenta and placentation in mammals.
- Parthenogenesis: natural and artificial.
- Regeneration mechanism in animals, steps of limb regeneration in amphibians
- Stem cells and their significance.

Unit V

- Elementary idea of the following developmental process –
 - embryonic induction,
 - organizer concept and
 - cytodifferentiation
- Teratogenesis: Genetic and environmental teratogenesis.
- Aging and senescence.

References:

- Developmental Biology by K.V.Sastry & Vinita Shukla – (Rastogi Publications, 2008).
- Introduction to Embryology by B.I. Balinsky – (W.B. Saunders, Philadelphia, 1976).
- Foundations of Embryology by B.M. Paten and B.M. Carison.
- Foundations of Animal Development by A.F. Hopper and N.H. Hart (Oxford University Press, New York, 1980).
- Vertebrate Embryology by R.S. McEwen (Oxford & IBM Publishing Co., New Delhi).
- Developmental Biology by J.W. Brookbank.
- Patterns and Principles of Animal Development by J.W. Saunders. Jr.
- Embryology by Barth IG (1966) – Holt Rinehart & Winston.
- Development by Berril N & Karp G (1960) – Holt Rinehart & Winston.
- Fundamentals of Comparative Embryology of Vertebrates by huettnner AF (1967) – McMillan Co.
- Chordate Embryology by Mohan Arora (1985) – Atma Ram & Sons.
- Laboratory manual of Vertebrate Embryology by Rugh R – Allied Pacific Pvt. Ltd.
- Chordate Embryology by Verma PS & Agarwal VK – Chand & Co.

PAPER II: ENVIRONMENTAL SCIENCES

Duration: 3 hours

Max. Marks: 50

Note: In this question paper ten questions will be set, two questions from each unit. Candidates have to answer five questions in all taking at least one question from each unit.

Objectives:

To enable students to understand the energy sources, flow of energy

and conservation; to understand the recycling of minerals and nutrients in ecosystems; to understand the dynamics of population; to understand causes of pollution; to comprehend origin of life.

Unit I

- Environment - Atmosphere, lithosphere and hydrosphere as habitats and ecological factors;
- Abiotic factors - Temperature and light - as ecological factors; limiting factors; Liebig - Blackman's law of limiting factors; Shelford's law of tolerance, Factor - compensation;
- Ecosystem - Types, structure, functions and examples; Dynamics of ecosystem - Ecological pyramids, energy flow in ecosystem, productivity, biogeochemical cycle - water, nitrogen and sulphur cycles, recycling of organic nutrients

Unit II

- Light and temperature as ecological factors.
- Ecological concept of species, niche concept.
- Population - Definition and attributes - density, natality, vital index, age distribution, growth patterns, migration, dispersal and dispersion, Environmental resistance, carrying capacity for a population.
- Biotic community - Definition and structure, ecotone, edge effects, niche, community stability; Ecological succession. Intra and Interspecific interaction - All types of animal associations.

Unit III

- Air Pollution: Sources, acid rain, photochemical smog, prevention and control.
- Water pollution: sources, prevention and control; eutrophication.
- Noise pollution: Sources, prevention and control.
- Soil pollution: Sources, prevention and control.
- Thermal pollution

Unit IV

- Green house effect and Global warming
- Depletion of ozone layer
- Natural disasters - Earthquake, Tsunami
- Biomagnifications.

Unit V

- Natural resources - non-renewable and renewable
- Conservation of natural resources
- Wild life of India causes of depletion of wild life, modes of wild life conservation, Red Data Book.

References:

- Fundamentals of Ecology by E.P. Odum - W.B. Saunders, Philadelphia)
- Environmental Studies by S.V.S.Rana - (Rastogi Publications, 2008)
- Animal Ecology by S.P.Singh, 6th Revised Edition - (Rastogi Publication 2008).

- Basic Ecology by E.P. Odum (Holt, Rinehart & Winston, New York).
- Ecology by S.K. Charles - (Prentice Hall of India, New Delhi).
- Ecology: Principles and Applications by Chapman E (1988) - Cambridge University Press.
- Modern Concept of ecology by Kumar HD (1986) - Vikas Publishing House.
- Ecology and Environment by Sharma PD (1991) - Rastogi Publications.
- Environmental Biology by Trivedi PR & Gurudeep Raj (1992).

PRACTICAL**Duration: 4 hours****Max. Marks: 50****Objectives:**

To develop the skills of staining and mounting of embryos of chick and Frog; to understand the developmental patterns of chick and Frog. To enable students to analyse for the physico-chemical and biological factors of water and soil samples; to identify and estimate quantitatively the aquatic and terrestrial organisms and their adaptation; to observe the population growth pattern.

Practical work based on Papers I and II**Course Content:**

- Study of types of sperm smears preparation.
- Study of different type of eggs (Insect, Frog, Hen)
- Study of Preserved material: eggs, cleavage, blastula, gastrula, neurula, tail bud, Hatching, mature tadpole larval metamorphic stages of toadlet/froglet.
- Study of Embryological slides of various stages of frog.
- Study of Embryological slides of various stages of chick.
- Study of Development of chick with the help of :
 - whole mounts: 18 hrs, 21 hrs, 24 hrs, 33 hrs, 48hrs, 56hrs, 72 hrs and 96 hrs of incubation period embryos.
 - Study of primitive streak stage in living embryo after removal of the blastoderm from the egg.
 - Study of the embryo at various stages of incubation in vivo by making a window in the egg shell.
 - Study of various fetal envelopes in a 10-12 day old chick embryo (Amnion, Chorion, allantois & Yolk sac).
- Frog embryology - Collection of spawn, identification of stages and preservation, preparation of permanent/temporary slide of representative developmental stages.
- Microtomy - Narcotisation fixation of tissues, processing and infiltration of wax, preparation of blocks, cutting of blocks, spreading of ribbons and staining for permanent slides for histological studies.
- Simulation of an ecosystem in the laboratory.
- Determination of oxygen content of water sample by Winkler's method.

11. Determination of chloride content of water sample.
12. Determination of sulphates content of water sample.
13. Determination of dissolved CO₂ content of water.
14. Determination of total solid contents of water.
15. Determination of pH of soil sample.
16. Determination of water content in a given sample of soil.
17. Detection of salts i.e. phosphates, sulphates, nitrates and chlorides in a given sample of water.
18. Construction of frequency table, histograms, polygons, pie-charts.
19. Exercise on mean, mode and median.

4. BOTANY

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	50	36
Paper II	3 hours	50	
Practical	4 hours	50	18

PAPER – I : STRUCTURE, DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS

UNIT-I

- a. The basic body plan of a flowering plant; Tissue types.
- b. **The shoot system:** The shoot apical meristems and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; formation of internodes, branching pattern; monopodial sympodial growth; canopy architecture; cambium and its functions; formation of secondary xylem; a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; secondary phloem – structure – function relationships; periderm

UNIT – II

- a. **Leaf:** Origin, development, arrangement and diversity in size and shape; internal structure in relation to photosynthesis and water loss; adaptations to water stress; stomatal types and trichomes; senescence and abscission.
- b. **The root system:** The root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.

UNIT – III

- a. **Flower:** A modified shoot; structure and function of anther and pistil; the male and female gametophytes; Types of pollination; attractions and rewards for pollinators.

UNIT – IV

- a. **Pollen-pistil interaction:** Sexual incompatibility; Genetic, physiological and biochemical basis rejection reaction; methods to overcome

incompatibility.

- b. **Fertilization:** Double fertilization, Apomixis, Parthenocarpy

UNIT – V

- a. **Embryo:** Embryo development in Dicots and monocots; structure and function of suspensor; Polyembryony.
- b. **Endosperm:** Types, development, cytology and function of endosperm.
- c. **Fruits:** Development, maturation and types.

PAPER – II : PLANT PHYSIOLOGY

UNIT-I

- a. **Plant-water relations:** Importance of water to plant life; physical properties of water; diffusion and osmosis; absorption and transport of water: Transpiration and physiology of guard cell movement. Factors affecting transpiration.
- b. **Translocation of organic substances:** mechanism of phloem transport; source – sink relationship; factors affecting translocation.

UNIT – II

Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effect; concept of two photosystems; Z-scheme, photophosphorylation; calvin cycle; C₄ pathway; CAM plants; photorespiration; factors influencing photosynthesis; C₃ & C₄ plants

UNIT – III

Respiration: ATP – The biological energy currency; aerobic and anaerobic respiration; respiratory substrates; Glycolytic pathway of glucose degradation to pyruvic acid; tricarboxylic acid cycle; electron transport mechanism (chemi – osmotic theory); redox potential; oxidative phosphorylation; pentose phosphate pathway. Factors affecting respiration.

UNIT – IV

- a. **Mineral nutrition:** criteria of essentiality of elements; essential macro – and micro-elements and their role; mineral uptake; deficiency and toxicity symptoms; water culture technique; foliar nutrition.
- b. **Nitrogen and lipid metabolism:** Biology of nitrogen – fixation; importance of nitrate reductase and its regulation; ammonium assimilation; structure and function of lipids; fatty acid biosynthesis; β -oxidation; saturated and unsaturated fatty-acids; storage and mobilization of fatty acids.

UNIT – V

Growth and development: Definitions; phases of growth and development; kinetics of growth; seed dormancy, seed germination and factors of their regulation; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; biological clocks; physiology of senescence, fruit ripening; plant hormones auxins, gibberellins, cytokinins, abscisic acid and ethylene, history of their

discovery, biosynthesis and mechanism of action, photomorphogenesis; phytochromes and cryptochromes, their discovery, physiological role and mechanism of action.

PRACTICALS

Duration : 4 hours

Max. Marks: 50

Course Content

The following experiments are to be conducted:

1. Anatomy of primary and secondary growth in monocots and dicots using hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood. Microscopic study of wood in T.S., T.L.S. and R.L.S. Anomalous Sec. growth in *Boerhaavia*, *Nyctanthus* and *Dracaena*
 2. Anatomy of leaf and Peel mount for stomatal types/trichomes.
 3. Anatomy of the root. Primary and secondary structure.
 4. Examination of a wide range of flowers available in the locality and methods of their pollination.
 5. Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using *in vitro* pollen germination.
 6. Structure of ovule and embryo sac development (using serial sections).
 7. Simple experiments to show vegetative propagation: leaf cuttings in *Bryophyllum*, *Sansevieria*, *Begonia*; stem cuttings in rose, *salix*, money plant, sugarcane and *Bougainvillea*.
 8. Germination of non-dormant and dormant seeds.
 9. To demonstrate osmosis using egg membrane, onion/tomato peels, potato osmoscope.
 10. To study the effect of temperature and alcohol on the permeability of membranes.
 11. To demonstrate plasmolysis.
 12. To compare the water holding capacity of soils (clay, peat and sand).
 13. To demonstrate transpiration pull.
 14. To compare the rates of transpiration in different environmental conditions. Ganong's potometer
 15. To demonstrate the evolution of oxygen during photosynthesis.
 16. To compare the rates of photosynthesis under different environmental conditions. bubble-count method).
 17. To demonstrate the necessity of light, CO₂ and chlorophyll for photosynthesis.
 18. Separation of photosynthetic pigments by paper chromatography.
 19. Demonstration of aerobic respiration.
 20. Demonstration of anaerobic respiration.
 21. To demonstrate the liberation of CO₂ during aerobic respiration.
- (B). Maintenance of a record of all activities performed.

5. MATHEMATICS

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hrs	75	54
Paper II	3 hrs	75	

PAPER I (COMPLEX ANALYSIS)

Duration: 3 hrs.

Max. Marks: 75

Note: In this question paper ten questions will be set, two questions from each unit. Candidates have to answer five questions in all taking at least one question from each unit.

Unit I Complex plane. Connected and compact sets, Curves and region in the complex plane, Statement of Jordan curves theorem, Extended complex plane and stereographic projection, Complex valued functions limits, Convergence, continuity, differentiability in the extended plane, Analytic functions.

Unit II Cauchy Reimann equations (Cartesian & Polar forms), Harmonic functions, Construction of an analytic function Conformal mapping. Bilinear transformation, and its properties, Elementary maps. $F(z) = \frac{1}{2}(z+1/z)$, z^2 , $2z$, $\sin z$ and $\log z$

Unit III Complex integration. Complex line integrals, Cauchy's integral theorem. Indefinite integral, Fundamental theorem of Integral calculus, Derivative of an analytic function, Liouville's theorem, Poisson's integral formula.

Unit IV Morera's theorem, Taylor's & Laurents series, Maximum, modulus principle, Schwarz's Lemma, Singularities, branchpoint, Moromorphic functions and Entire functions, Reimann's theorem, Casorati Wierstrass theorem, Residue theorem, Argument Principle.

Unit V Rouche's theorem, Fundamental theorem of Algebra, mittag-Leffe's expansion theorem, Evaluation of real definite integral by contour integration, Analytic continuation, power series method of analytic continuation, Schwarz reflection principle.

PAPER II(MECHANICS)

Duration: 3 hrs

Max. Marks: 75

Note: In this question paper ten questions will be set, two questions from each unit. Candidates have to answer five questions in all taking at least one question from each unit.

Unit I Analytical conditions of equilibrium of coplanar forces, Virtual Work, Catenary, Center of Gravity.

Unit II Forces in three dimensions, Poinsot's central axis, Wrenches, Null lines and planes, Stable and unstable equilibrium.

Unit III Velocities and accelerations along radial and transverse directions, and along tangential and normal directions, Simple Harmonic Motion,

Rectilinear motion under variable laws.

Unit IV Motion in resisting medium, Hook's law, related problems on horizontal and vertical elastic strings. Constrained motion, circular and Cycloidal motion.

Unit V Impact, Direct and oblique, Central forces, Central orbits, p-r equation, Apses, Time in an orbit, Kepler's laws of planetary motion.

6. INSTRUCTIONAL STRATEGIES AND SKILLS

Contact Hrs. 4 periods/week

Max. Marks 75

Examination Duration : 3 hrs.

Min. Marks 27

Objectives:

Note: Ten questions will be set in all, two questions from each unit. Candidates have to answer five questions taking one questions from each unit.

On completion of the course the student teacher will be able to:

- understand different skills and strategies of teaching.
- develop essential competencies in their use in teaching.
- understand and appreciate the use of different types of instructional media and materials.
- prepare and use appropriate instructional materials for effective classroom transaction.
- understand use of modern approaches in teaching learning process.
- practice teaching skills.
- understand basic statistics and develop essential competencies in using such statistics for interpreting school and classroom dates.

UNIT I

Concept of Teaching and Instructions

Meaning, Concept & theories of teaching, instruction and training and basic assumptions. Relationship between teaching and learning Teaching as an art and science. Stages of teaching: pre active, inter active and post active. Levels of teaching: memory, understanding and Reflective.

UNIT II

Mechanism of feedback devices for improving teaching; micro teaching, simulated teaching, interaction analysis techniques.

Different skills :

Introducing a lesson, questioning, demonstration, illustration with example, explanation, reinforcement stimulus variation and use of black board.

UNIT III

Educational Technology : Its origin and concepts, its types, objectives, need and importance.

Distinction between hardware and software technologies. Their role in modern educational practices.

Hardware technologies : Important accessories and their application –

OHP still and Movie Projectors, Audio video recording instruments, TV computer, New technologies like e-mail, internet etc.

Use of strategies like teleconferencing, programmed instruction, CAI language laboratory.

UNIT IV

Models of Teaching

Concept of Models of teaching, need for alternatives strategies in teaching.

Different modes : Information processing, advance Organizer, Inquiry model, Inductive Thinking Model, Behaviour modification model.

(Each model is to be discussed in terms of meaning principal, characteristics syntax, social system, support system and application)

UNIT V

Analysis of Data and Interpretation

Mean, median, mode, standard deviation, quartile deviation, range, percentile and correlation rank method. Graphical representation of the data and its representation.

Histogram, frequency polygon and pie diagram.

Action research; concept and application, Action Research Plan

Reference books

- a) Educational Psychology : A cognitive View : by D. Ausubel
- b) Improving Teaching : by E Amidone and E. Hunter
- c) The Art of Teaching : by H. Gilbert
- d) Teaching : A Psychological Analysis : by C.M. Fleming.
- e) Synthesis of Teaching Methods by M. A. Shilley.
- f) Becoming Better Teacher : Micro Teaching Approach : by P.K. Passi.
- g) Core Teaching Skills : the Micro Teaching Approach by N. K. Jangira and Ajit Singh.
- h) Statistics in Psychology and Education by H.E. Gaarrett
- i) Models of Teaching by B. Joyce and M. Weils
- j) Dececco, John P : Psychology of learning and instruction : Educational Psychology, Prentice Hall of India, New Delhi.

7 (A) TEACHING OF BIOLOGICAL SCIENCES

Duration: 3 Hrs.

Max. Marks: 75

Min. for pass: 27

Note: Ten questions will be set in all, two questions from each unit.

Candidates have to answer five questions taking one questions from each unit.

Objectives:

On completion of the course the student teacher will be able to

- Understand the nature and scope of Biological Sciences and its relation

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to society and human welfare.

- Develop the competencies in formulating objectives, designing instructional materials and using instructional strategies.
- Understand the Biological Science curriculum and the methodology of teaching.
- Use the various techniques of evaluation and develop the competencies in undertaking evaluation based on such techniques.
- Appreciate the role of Biological Science in human life.

Unit I: Aims and Objectives and Outcomes of Teaching Biology

- (a) Biological Science-Nature and Scope
- (b) Emergence and development of biology
- (c) Biology in relation to society and human welfare
- (d) General aims and objectives of teaching Biological sciences.
- (e) Bloom's taxonomy of educational objectives and its significance.
- (f) Concept mapping in Biology and its importance in teaching learning.
- (g) General and Specific objectives of teaching Biological Sciences.

Unit II: Curriculum

- (a) Concept of curriculum, Historical background of Biology curriculum and its studies. Biological sciences curriculum study project.
- (b) Principles of curriculum construction, curriculum development process, techniques of structuring and restructuring of curriculum, trends in curriculum development in Biology, analysis of existing Biology syllabi and study of recent trends/innovations in biological sciences.
- (c) NCF – 2005 - Guiding principles for secondary school science teaching and salient features.
- (d) Constructivism: Constructivist epistemology; types of constructivism; constructivist learning design; five E's; constructivist classroom, teacher and lesson.

Unit III: Methods/Approaches of Teaching Biological sciences

- (a) Teaching – Learning approaches.
- (b) Lecture method; lecture-cum-demonstration method; laboratory method; heuristic method; problem solving method; project method; discussion method; assignment method; inductive-deductive approach; science, technology and Society approach (STS).
- (c) Unit and Lesson Planning- Concept of planning-Variou steps in planning, their importance and advantages of planning. Preparation of lesson Plans.
- (d) Teaching skills: characteristics, important teaching skills.
- (e) Teaching aids: Types, advantages, principle for the selection of proper teaching aids and their use. Innovations and improvisations of teaching aids in class room teaching-including low cost teaching aids.

Unit IV: Biology Laboratory, Museum and Laboratory Techniques

- (a) Planning and layout of Biology laboratory and museum.
- (b) Administration of a laboratory.
- (c) Maintenance and care of laboratory resources (equipments and apparatuses), stock registers and their entries.
- (d) Safety measures in the laboratory and kits.
- (e) Low cost improvised apparatus, science kit.
- (f) Developing competencies in laboratory techniques.
- (g) Field trips and use of community resources.

Unit V: ICT and e-learning in Biology teaching and Evaluation

- (b) ICT: Introduction, use of ICT in teaching and learning, ICT resources to support Biology teaching and learning.
- (c) E-learning: Introduction, E-learning and changing nature of classroom challenges and drawbacks of e-learning.
- (d) Evaluation: Meaning, concept of test, measurement, assessment and evaluation, various types of evaluation, performance-based evaluation in Biology, achievement test, continuous and comprehensive evaluation preparation of test items.

Reference books

- Narendra Vaidya, The impact of Science Teaching, New Delhi: Oxford and IBH publishing Company Pvt. Ltd.
- R.C. Sharma, 1987. Modern Science Teaching, New Delhi: Dhanpatsa & Sons.
- David Layton (Ed): Innovations in Science and Technology Education New Delhi: Sterling publisher.
- Siddiqui & Siddiqui, Teaching of Science Today and Tomorrow New Delhi: Docba House.
- Benzamin S. Bloom. Taxonomy of Educational Objectives Hard book 1 Cognitive Domain, New York: Harcourt Brau and World Inc.
- Narendra Vidya and J.S. Rajput (Eds); Reshaping our school Science Education, New Delhi: Oxford & IBH Publishing House.
- Thurbex and Collitte, Teaching Science in Today's Secondary school New Delhi: PHI Pvt. Ltd.

7 (B) TEACHING OF CHEMISTRY

Duration: 3 Hrs.

Max. Marks: 75

Min. for Pass: 27

Note: In this question paper ten questions will be set (two from each unit) Candidates have to answer five questions taking one question from each unit.

Objectives:

The Pupil teachers will be able to –

1. Understand the application of Pedagogical concepts in teaching Chemistry.

1. Select appropriate teaching method and devise appropriate learning situation.
2. Prepare unit and lesson plans using various teaching methods.
3. Critically evaluate the existing curriculum and design the curriculum.
4. Prepare Achievement test.
5. Skillfully handle the resource material and Laboratory.

Course Content

Unit I

Nature of Chemistry & Instructional Objectives

(A) Nature of Chemistry

Structure of chemistry and its implications for teaching methods.

Chemistry as an experimental science.

Elation of chemistry to other sciences – Physics, Biology & Maths.

Chemistry and environment.

Chemistry & Society – role of chemistry in industry, agriculture and daily life.

(B) Objectives of Teaching Chemistry

(a) Learning & instructional objectives.

(b) Bloom's taxonomy of Educational objectives as applied to Chemistry.

(c) Defining process and product learning objectives.

(d) Construction of knowledge – Concept mapping.

(e) Relating objectives to instructional strategies & evaluation procedures.

(C) Developing attitude, interest and creativity through teaching of Chemistry

Special reference to chemistry fairs, exhibitions and clubs.

Chemical demonstrations to public.

Preparation of creative & useful equipments/products.

Unit II

Chemistry Curriculum

Place of Chemistry in school curriculum.

Principles of Curriculum construction with reference to Subject centered.

- c. Study of some typical curriculum: Chemistry Educations, Material study (Chem Study), Nuffield Curriculum – O' level, Saltors Chemistry (U.K.), Chem. Com (U.S.A.), National Curriculum, Critical evaluation of some of these curricula, Guiding principles of NCF – 2005 and its salient features for secondary school science teaching environmental and peace perspectives.

Unit III

Instructional Strategies

- a. Lecture method
- b. Demonstration method
- c. Demonstrations cum discussion
- d. Investigative approach
- e. Problem Solving

- f. Project method.
- g. Concept Mapping
- h. NCF – 2005 teaching for construction of knowledge and the value of interaction
- i. Preparation of Unit plans and lesson plans based on these methods.

Unit IV

Evaluation

(A) Concept of Evaluation

a. Formative and Summative Evaluation

b. Norms referenced and Criterion referenced evaluation

c. Internal and External evaluation

(B) Tools & Techniques of Evaluation

a. Test-written, oral, practical and Project work.

b. Qualities of a good test-Reliability. Validity & Practicability.

c. Preparing an achievement test-design, blue print, Marking scheme.

d. Writing test items-Objectives (Multiple choice Matching fill in the blanks, True/False). Short answer, long answer (essay).

e. Suggestion of NCF, 2005- regarding evaluation: self-assessment and self-evaluation. Continuous and comprehensive evaluation, scope advantage and limitations advantages & diagnostic tests and analysis of results.

f. Rating Scales

g. Preparation of diagnostic tests and analysis of results

Unit V

Facilities for Teaching of Chemistry

(A) Resource Materials

a. Print Media-Text books, Reference books, Science Magazines

b. Characteristics of a good text books.

c. Use of text book by teachers and students.

d. Electronic Media – Radio T.V. Films, Video Conferencing

(B) Chemistry Laboratory

Layout plan, equipments, furniture, reagents.

Preparation of reagents and solutions for laboratory.

Preparation of Low cost/Improvised apparatus.

Development of activities/experiments for enhancing learning.

Safety measures in Laboratory.

Reference Books:

1. Waddington: Teaching School Chemistry: UNESCO, Paris.
2. UNESCO: Trends in Teaching Chemistry:
3. UNESCO: New Source Book for Science Teaching.
4. UNESCO: Handbook for Science Teacher.
5. Novak & Gowin: Learning how to learn
6. Arnold Allcott & Bolton M.S.: Chemistry Today

7(C) TEACHING OF PHYSICAL SCIENCE

Duration: 3 Hrs. **Max. Marks:** 75 **Min. for Pass:** 27

Note: Ten questions will be set in all, two from each unit. Candidates have to answer five questions, one question from each unit.

Objectives

To enable pupil teacher to:

1. make familiar with aims and objectives of teaching physical science.
2. provide experience for construction & use of various teaching aids and educational technologies available to improve instructional practice.
3. analyse school syllabus of science in relation to unit plan, lesson plan.
4. use the available facilities inside the school and outside the school for teaching of physical science.
5. organize co-curricular activities related to science.
6. develop understanding of the methods most appropriate to assess the progress & achievement of the pupil using variety of tools and techniques for theory & practice

Course Content:

Unit – I

Objectives of teaching science

- Physical science as fundamental component of science.
- Correlation with other sciences and school subjects.
- Importance of physical science in daily life.
- Importance of science as a school subject with special reference to physical science.
- Objectives of teaching Physical science at different stages of school education.
- Classification of Objectives into different categories (Bloom's Taxonomy).
- General objectives and Specific Objectives.
- Objectives of practical work in Physical science.
- Writing Behavioural Objectives.
- Values outcome through teaching of science.
- Development of scientific temper and scientific attitude through teaching science.

Unit II

Curriculum

- Principles of planning science Curriculum for Secondary and discipline oriented syllabi for Sr. Sec. classes.
- Importance of basic concepts in Physical science.
- Guide lines for the selection and organization of content.
- Critical appraisal of the prescribed syllabus of physical sciences at secondary level.
- Principles underlying the curriculum construction related to PSSC, HPP

and Nuffield (Physics), Chem study, Nuffield (chem), Concept of curriculum framework.

Guiding principles of NCF – 2005, salient features for secondary school science teaching.

Content analysis, Unit plan, Lesson Plan

- Necessity of planning, unit plan and lesson plan in physical science.
- Content analysis of physical science.
- Preparation of unit and lesson plan on selected topics from Physical Science portions of secondary level science.

Unit III

Methods of Teaching

- Outcomes of learning theories for effective teaching-learning of physical science.
- Methods of teaching:
 - Lecture method, Lecture cum Demonstration method,
 - Heuristic method, Laboratory method, Inductive and Deductive methods,
 - Problem solving method and project method,
 - Recent Trends in Teaching of Physical science.
 - Activity based teaching
 - Self learning material in physical science
 - Concept mapping, NCF 2005 – Teaching for construction of knowledge and the value of interaction.
 - Use of ICT in teaching of physical science, Concept of virtual class.

Unit IV

Facilities for Teaching Physical science

- Library, Audio-Visual Aids, Educational Technology, Teaching aids, Science kit, Models, Textbooks, Illustrative charts, Science Club, Use of local resources for teaching physical science, field trip preparation of low cost activities.
- Laboratory: Importance of laboratory work in physical science, Organisation of Laboratory Work, Maintenance and care of apparatus, Safety Precautions, Storage, working tables and supervision of Individual work.
- Science Teacher: As a subject expert, facilitator of learning, Counsellor, evaluator.
- Use of educational technology hardware, software technology, important accessories, OHP, Slide projectors, AV instruments, TV, Computers, internet, teleconferencing, CAI, Programmed instructions.

Unit V

Evaluation

- Concept of measurement & evaluation.
- Importance of evaluation for Qualitative improvement in teaching and learning

Techniques of evaluation: Oral, observation, written.

Characteristics of a good test/question.

Preparation of blue print, Framing Essay type, short answer type, very short answer type and MCQs, their advantages and limitations. Recommendations of NCF-2005 regarding evaluation, self-assessment and self-evaluation. Continuous and comprehensive evaluation, scope, advantages and limitations.

Construction of achievement test. difficulty level and discrimination power of a question.

Mastery learning, preparation of diagnostic test and analysis of the results.

References:

1. NCERT (2000) National Curriculum Framework for School Education, New Delhi.
2. NCERT (2001), Guidelines and Syllabi for Upper Primary and Secondary Stage.
3. NCERT Science and Technology – Textbook for classes IX & X.
4. NCERT, Textbook for Physics, Chemistry for Sr. Sec. classes.
5. Ralph E. Martin Jr. Colleen Sexton, Kay Wagner & Jack Gerlovich, teaching Science for all children, Allyn and Becon, Massachusetts 1994.
6. Lewis J. Teaching of School Physics, Penguin UNRSCO.
7. Novak J.D. and Gowin, D.B. Learning how to learn, Cambridge University Press, Cambridge.
8. Driver, R. Pupil as a scientist, Open University Press, Buckingham.
9. Saxena, A. B. Vigyan Shikshan Ka Ayojan, Har Prasad Mhargava & Sons, Agra.
10. Thurber, W. & Collette, A.: teaching of science in today's secondary schools. Boston Allyn & Bacon, 1964.
11. Heiss, E. Obourn F. & Hoffmann C: Modern science teaching, Macmillan Co. New York, 1961.
12. Brandewin, P.E. Waston F.G & Blackwood, P.E.: A book of methods teaching high school science.
13. Vaidya, N: The impact science teaching. Oxford & IBH. New Delhi, 1971.
14. UNESCO: Physics Teaching/Chemistry teaching/Physical science teaching.

7(D) TEACHING OF MATHEMATICS

Duration: 3 Hrs.

Max. Marks: 75

Min. for Pass: 27

Note: Ten questions will be set in all, two from each unit. Candidates have to answer five questions, one question from each unit.

OBJECTIVES

To enable students to:

Understand and appreciate mathematical structures and their

isomorphism with physical realities.

Understand the basic concepts and their unifying strength and applicability.

Understand the nature of mathematics with reference to school mathematics and plan instructional strategies in mathematics.

Understand the techniques of evaluation and develop the competencies in preparing tools of evaluation in mathematics.

Unit I

A) Diagnostic, Remedial and Enrichment program with respect to the following content areas

Set theory and mathematical structures – sets. Relations and functions and elementary idea of Boolean algebra.

Statistics-Graphical representation of the statistical data, Measures of central tendency, dispersion and coefficient of correlation.

Shortcomings of Euclidean Geometry, Axiomatic development of Geometry.

B) Nature of Mathematics

Importance of mathematics in the secondary school curriculum. History of mathematics and contribution of India mathematicians, Meaning of mathematics according to the following school of thought:

Logicists.

Intuitionists.

Formalists.

Unit II

Planning instruction in mathematics

Selecting content for instruction, identifying teaching points for mathematics lesson, organization of content, Stating instructional objectives for a mathematics lesson and identifying learning outcomes in the behavioural terms. Designing – learning experiences: appropriate strategies: teaching aids, evaluation tools etc. –

Writing lesson plans for mathematics lessons.

Planning a unit of instruction in mathematics.

Role of multiplicity of approaches in teaching of mathematics with suitable examples, NCF-2005.

Unit III

Mathematics curriculum

a) Strategy and principles of curriculum construction for the secondary level, Recent trends in mathematics curriculum, Critical evaluation of existing mathematics curriculum/text book at different levels of secondary education. Salient features of NCF-2005.

(b) Methods of teaching

(i) Inductive and deductive

(ii) Analytic and synthetic

- (iii) Demonstration and Laboratory
- (iv) Heuristic and Project
- (v) Problem Solving
- (vi) Programmed Learning.

Unit IV**Teaching aids in mathematics**

- (a) (i) Mathematics laboratory (Planning & equipment)
- (ii) Audio Visual Aids, film strips, field trip and excursion, Mathematics association, Work book.
- (b) Study of Mathematics Projects
- School Mathematics study group (SMSG)
- Nuffield Mathematics Projects (N.M.P.)
- NCERT Mathematics curriculum improvement project.

UNIT V**Evaluation In mathematics:**

- i) Meaning of evaluation, distinction between evaluation and examination. It's characteristics and functions.
- ii) Relationship between objectives, learning experience and evaluation.
- iii) Preparation and use of tests for evaluation such as achievement tests, diagnostic test, aptitude tests, observation schedules in mathematics.
- iv) Characteristics of a good evaluation tool in Mathematics.
- v). Salient features of NCF, 2005- regarding evaluation: self-assessment and self-evaluation. Continuous and comprehensive evaluation, scope, advantage and limitations advantages & diagnostic tests and analysis of results.

Reference books

1. NCERT, New Delhi : A Text Book of Content-cum-Methodology of Teaching Mathematics.
2. Cooney T.J. and other : Dynamics of Teaching Secondary School Mathematics.
3. Mangal S.K. : Teaching of Mathematics, Prakash Bros. Ludhiana.
4. Sidhu K.S. : Teaching of Mathematics, sterling Publications, N. Delhi.
5. SMSG & NMP : Text books and Teacher's Guides.
6. UNESCO : New Trends in Mathematics Teaching.

SCHEME OF B.SC. B.ED. PART IV EXAMINATION**1. PHYSICS**

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	50	36
Paper II	3 hours	50	
Practical	4 hours	50	18

Note: There will be two experiments . The distribution of marks will be as follows: Two experiments (one from each group)

each of 15 marks	30 marks
Viva	10 marks
Record	10 marks
Total	50 marks

PAPER – I: QUANTUM MECHANICS AND RELATIVITY**Duration: 3 hrs.****Max. Marks – 50**

Note:- The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit. MKSA system of units is to be used. The question paper shall have atleast 30 per cent weightage of problems and numericals.

Unit-I**Relativity**

Reference systems, inertial frames, Galilean invariance and conservation laws, propagation of light, Michelson – Morley experiment. Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass-energy equivalence, particle with a zero rest mass.

Unit-II**Quantum Mechanics**

Origin of the quantum theory- Failure of classical physics to explain the phenomena such as black-body spectrum, photoelectric effect, Ritz combination principle in spectra, stability of an atom, Planck's radiation law, Einstein's explanation of photoelectric effect, Bohr's quantization of angular momentum and its applications to hydrogen atom, limitations of Bohr's theory.

Unit III

Wave-particle duality and uncertainty principle- de Broglie's hypothesis for matter waves, the concept of wave and group velocities, evidence for diffraction and interference of 'particles', experimental demonstration of matter waves.

Consequence of de Broglie's concepts; quantisation in hydrogen atom;

energies of a particle in a box, wave packets, Heisenberg's uncertainty relation for p and x , its extension to energy and time.

Consequence of the uncertainty relation: gamma ray microscope, diffraction at a slit, particle in a box, position of electron in a Bohr orbit. Quantum Mechanics: Schrodinger's equation, Postulatory basis of quantum mechanics; operators, expectation values, transition probabilities.

Unit IV

Applications of quantum mechanics to particle in a one dimension and three dimensional box, harmonic oscillator, reflection at a step potential, transmission across a potential barrier.

Hydrogen atom; natural occurrence of n , l and m quantum numbers, the related physical quantities, comparison with Bohr's theory. Wave functions, Probabilistic interpretation.

Unit V

Lasers

Laser system; Purity of a spectral line, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients. Spontaneous and induced emissions, conditions for laser action, population inversion.

Applications of Pulsed and tunable lasers, spatial coherence and directionality, estimates of beam intensity, temporal coherence and spectral energy density.

Lasers and nonlinear optics: Polarization P including higher order terms in E and generation of harmonics, momentum mismatch and choice of the right crystal and direction for compensation.

Text and Reference Books

1. H.S. Mani and G.K. Mehta: Introduction to Modern Physics Affiliated East West Press Pvt. Ltd. New Delhi, 1998.
2. A. K. Ghatak and S. Lokanathan: Quantum Mechanics- Theory and Application Macmillan India Ltd. Delhi.
3. Non-relativistic Quantum Mechanics, Landau and Lifshitz.
4. A.K. Ghatak, Physical Optics
5. D. P. Khandewal, Optics and Atomic Physics (Himalaya Publishing House, Bombay, 1998)
6. B.B. Laud; Lasers and Non-linear Optics (Wiley Eastern 1985)

PAPER II ATOMIC, MOLECULAR & NUCLEAR PHYSICS

Duration 3 hrs.

Max. Marks – 50

Note:- The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question

from each unit. MKSA system of units is to be used. The question paper shall have atleast 30 per cent weightage of problems and numericals.

Unit – I

Spectra of hydrogen, deuteron and alkali atoms spectral terms, doublet fine structure, screening constants for alkali spectra for s,p,d and f states, selection rules, L-S and J-J couplings.

Weak spectra: continuous X-ray spectrum and its dependence on voltage, Duane and Hunt's law. Characteristic X-rays. Moseley's law, doublet structure of X-ray spectra, X-ray absorption spectra.

Unit II

Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of internuclear distance, pure rotational and rotation vibration spectra. Dissociation limit for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra.

Unit III

Raman effect, Stokes and anti-Stokes lines, complimentary character of Raman and infrared spectra, experimental arrangements for Raman spectroscopy.

Spectroscopic techniques: Sources of excitation, prism and grating spectrographs for visible, UV and IR. absorption spectroscopy, double beam instruments, different recording systems.

Unit IV

Interaction of charged particles and neutrons with matter, working of nuclear detectors, G-M counter, proportional counter and scintillation counter, cloud chambers, spark chamber, emulsions.

Structure of nuclei, basic properties (I , m , Q and binding energy), deuteron binding energy, p-p and n-p scattering and general concepts of nuclear forces. Beta decay, range of alpha particle, Geiger-Nuttal law. Gamow's explanation of beta decay, alpha decay and continuous and discrete spectra.

Unit V

Nuclear reactions, channels, compound nucleus, direct reaction (concepts)

Shell model; liquid drop model, fusion (concepts), energy production in stars by p-p and carbon cycles (concepts).

Text and Reference Books

- H.S. Mani and G.K. Mehta: Introduction to Modern Physics Affiliated East West Press Pvt. Ltd. New Delhi, 1998.
 A Beiser; Prospective of Modern Physics
 H E White; Introduction to Atomic Physics
 Barrow; Introduction to Molecular Physics

R P Feymann, R B Leighton and M Sands; The Feymann Lectures on Physics, Vol. III (Narosa Publications, Bombay, Delhi, Calcutta, Madras)
T A Littlefield and N Thorley; Atomic and Nuclear Physics (Engineering Language Book Society)

H A Enge Introduction to Nuclear Physics (Addison-Wesley)
Eisenberg and Resnik; Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles (John Wiley)

D P Khandelwal; Optics and Atomic Physics, (Himalaya Publishing, Bombay, 1988)

PRACTICALS

Duration: 5 hours **Max. Marks: 50** **Min. Marks for Pass: 18**

Any twelve of the following experiments are to be performed

1. Study of normal frequencies and of two coupled oscillators as function of coupling factors.
2. Verification of the second law of thermodynamics using thermo-electric device as heat engine and heat pump.
3. Measurement of Hall coefficient of given material.
4. Determination of Rydberg constant with discharge tube and spectrometer.
5. Determination of Planck's constant with photo emissive cells.
6. Measurement of electronic charge 'e' by Millikan's experiment.
7. Study of magnetic Hysteresis parameters using a CRO.
8. Study of resistance characteristics of semi-conductor Material using four probe Method.
9. To determine the value of a High resistance by Leakage method.
10. To find the temperature of a flame using DVS.
11. Study of flame spectra of some elements.
12. To determine small thickness by using thin film interference.
13. To determine the wavelength by Newton's ring experiment.
14. Determine Y by interference method.
15. The study of frequency response and phase relationship in a serried LCR circuit.
16. Study of the absorption spectrum of iodine vapours-energy levels, excitation energy and vibrational constt.
17. Study of temperature dependence of thermal radiations, spectral distribution, total radiation and Planck's constant.
18. Study of statistical distribution: Gaussian and Poisson's spectral distribution using dices.
19. Experimental study of Fourier analysis.
20. Measurement of magnetic susceptibility.
21. Determine of e/m by Thomson's method.
22. Verification of inverse square law by Photo cell.

2. CHEMISTRY

Paper I Inorganic Chemistry	3 hrs.	50	}	36
Paper II Organic Chemistry	3 hrs.	50		
Practicals	5 hrs.	50		18

PAPER – I – INORGANIC CHEMISTRY

Duration : 3 hrs.

Max. Marks: 50

Note: The paper is divided into five independent units. Two questions will be set from each unit. Candidates are required to attempt one question from each unit.

Unit – I

Coordination compounds:

Werner's theory, nomenclature, chelates, stereochemistry of different coordination number, isomerism in coordination complexes, elementary idea of valence bond and crystal field theory to explain bonding in transition metal complexes, Explanation of magnetism, geometry and spectral behaviour and colour of coordination complexes on the basis of above theories.

Unit – II

Metallic carbonyls and metallic nitrosyls: Metallic carbonyls General methods of Preparation, general properties, structure and nature of Metal carbonyls, bonding in carbonyls, Effective atomic number (EAN) rules as applied to metallic carbonyls. 18-electron rules applied to metallic carbonyls. Preparation, properties and structure of nickel tetracarbonyl, iron penta carbonyls, chromium hexa carbonyls, dimanganese deca carbonyl, dicobalt octa carbonyl.

Metallic nitrosyls: Some metallic notrosyls: Metal nitrosyl carbonyls, metal nitrosyl halides, sodium nitroprusside(Preparation, properties, structures and uses) structure and nature of M-N bonding in nitrosyl. Effective atomic number (EAN) rules as applied to metallic nitrosyls.

Unit–III

Organometallic Chemistry: Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal-ethylenic complexes and homogeneous hydrogenation,

Unit – IV

Non aqueous solvents: Classification of solvent, general study of ionizing solvents with special reference to liquid ammonia, liquid sulphur dioxide, liquid hydrogen fluoride, anhydrous sulphuric acid.

Unit – V

Application of the following reagents in inorganic analysis (a) Oxine (b)

dimethylglyoxime (c) Cupferron (d) a-nitroso b-naphthol (e) Phenylarsenic acid (f) Nitron (g) Potassium iodate (h) Chloro amine T.

PAPER – II – ORGANIC CHEMISTRY

Duration : 3 hrs.

Max. Marks: 50

Note:- The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

Unit – I

Spectroscopy:

Nuclear magnetic resonance (NMR) spectroscopy.

Proton magnetic resonance (^1H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, area of signals and proton counting, splitting of signals spin-spin coupling and coupling constant, interpretation of NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1, 1, 2-tribromoethane, ethyl acetate, toluene and acetophenone.

Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and NMR spectroscopic techniques.

Unit – II

(i) Organometallic Compounds:

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions.

Organozinc compounds: formation and chemical reactions.

Organolithium compounds: formation and chemical reactions.

(ii) Organosulphur Compounds

Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

Unit – III

(i) Organic Synthesis via Enolates

Acidity of α -hydrogens. Synthesis of ethyl acetoacetate by Claisen condensation and Synthesis of diethyl malonate. Keto-enol tautomerism in ethyl acetoacetate. Synthetic applications of ethyl acetoacetate and diethyl malonate. Alkylation of 1,3-dithianes.

(ii) Fats, Oils and Detergents

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl aryl sulphonates.

Unit – IV

(a) **Carbohydrates:** Classification and nomenclature. Monosaccharides,

Configuration of monosaccharides. Mechanism of osazone formation. interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Erythro and threo diastereomers. Structure of glucose including ring size determination and cyclic structure. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Mechanism of mutarotation.

Structure of ribose and deoxyribose.

Introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

(b) Amino Acids, Peptides, Proteins and Nucleic Acids

classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α -amino acids.

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides and proteins. Primary and secondary structures of proteins. Protein denaturation/renaturation.

Nucleic acids: introduction. Constitution of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Unit – V

(a) Polymers

Introduction, addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers.

Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxyresins and polyurethanes.

Natural and synthetic rubbers.

(b) Dyes

Theory of Colour and Constitution, Classification of dyes. Synthesis and uses of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and indigo.

PRACTICALS

Duration: 5 hours

Max. Marks: 50

Min. for pass: 18

1. (i) Quantitative estimation of one metal volumetrically from a given mixture.
 - a) To estimate magnesium volumetrically from a mixture containing Ba^{2+} and Mg^{2+} ions, Zn^{2+} and Mg^{2+} ions.
 - b) To estimate copper iodometrically from a given mixture containing

Pb^{2+} and Cu^{2+} ions.

- (ii) To detect the presence of three cations and three anions in a given mixture qualitatively.
2. Estimation of Glucose with the help of Fehling's solution.
 3. Determination of Total hardness of water.
 4. Two stage preparation of the following:
p-nitroacetanilide from Aniline.
P-Bromoacetanilide from Aniline.
 5. Determination of Iodine value of an oil/fat.
 6. Separation of two component mixture using water or $NaHCO_3$ solution & identification of the two components. Preparation of one derivative.
 7. Conductometric Acid – Base Titration.
 8. Potentiometric Acid – Base Titration.
 9. pH metric Acid-Base Titration.
 10. Study the Kinetics of acid hydrolysis of an ester.
 11. Study the kinetics of the alkali hydrolysis of an ester.

Instrumentation

Colorimetry

1. Determination of formula of complex by Job's method
2. Verification of Beer – Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.

Solvent Extraction

Separation and estimation of Mg (II) and Zn (II)

Ion Exchange Method

Separation and estimation of Mg (II) and Zn (II).

Polarimetry

Determination of the specific rotation of a given optically active compound and determination of the concentration of given solution of an optically active substance.

3. ZOOLOGY

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	50	36
Paper II	3 hours	50	
Practical	4 hours	50	18

PAPER I: EVOLUTION AND PALEONTOLOGY

Duration: 3 hours

Max. Marks: 50

Objectives:

To enable students to understand and comprehend origin of life and theories of evolution; to understand the evolution from the evidences.

Note: In this question paper ten questions will be set two questions from

each unit. Candidates have to answer five questions taking one question from each unit.

Unit I

- a) Origin of life (Abiogenesis and biogenesis)
- b) Evidences in favour of evolution: Evidences from morphology and comparative anatomy, embryology and paleontology.
- c) Molecular basis of evolution

Unit II

Theories of evolution:

- a) Lamarckism or inheritance of acquired characters and Neo-Lamarckism.
- b) Darwinism or theory of natural selection and Neo Darwinism.
- c) Mutation theory of Devries.
- d) Weismann theory of germplasm.
- e) Recapitulation theory

Unit III

- a) Variation: Kinds, sources of variation, origin of new mutations.
- b) Isolation: Definition, mechanism and role of isolation in evolution.
- c) Adaptation: Introduction, kinds (structural, physiological and protective), animal associations, divergent evolution, convergent evolution, evolutionary significance of adaptation.

Unit IV

- a) Origin of species: Factors causing genetic divergence in the population of species, genetic drifts, Bottle neck effect, founder's effect, species.
- b) Mimicry and protective coloration: Definition, kinds, condition necessary for mimicry, significances.
- c) Geographical distribution of animals: geographical time scale, eras, origin and evolution of reptiles and mammals.

Unit V

- a) Introduction, formation, kinds, determination of age of fossil and significance.
- b) Evolution of horse: Place and time of origin, evolutionary trend and phylogeny.
- c) Evolution of man: Time of origin, compelling causes, ancestor of man, evolution from apes and evolutionary trends.

References

10. Evolutionary Biology by B.S. Tomar & S.P. Singh – (Rastogi Publications, 2008).
11. The origin of life by K. John – (Reinhold Publishing Corpn).
12. The evolution of Man by G.W. Lasker – (Holt, Rinehart & Winston).
13. Organic Evolution by R.S. Lull – (MacMillan).
14. Organic evolution – V. B. Rastogi.

PAPER II – MOLECULAR GENETICS AND BIOTECHNOLOGY

Duration: 3 hours

Max. Marks: 50

Objectives:

To enable students to comprehend the modern concepts and applied aspects of molecular, Genetic biology and biotechnology.

Note: Ten questions will be set, two from each unit. Candidates are required to answer five questions selecting one from each unit.

Unit I

- Nucleic acids: DNA (prokaryotic and eukaryotic) – Structure, forms, chemical composition, functions and units of DNA.
- RNA: Genetic RNA, non-genetic RNAs (mRNA, tRNA and rRNA) – structure and functions.
- Replication of DNA

Unit II

- Gene mutation: nature of mutation, types of mutation and causes of mutation.
- DNA repair: mismatch repair, direct repair, base-excision repair, nucleotide-excision repair and other types of DNA repair. Genetic diseases and faulty DNA repair.
- Transposon: Bacterial and eukaryotic transposable elements and mechanism of transposition.

Unit III

- Gene expression: Transcription of mRNA in prokaryotes and eukaryotes.
- Processing of mRNA in eukaryotes.
- Genetic code
- Gene expression: Translation in prokaryotes and eukaryotes.
- Regulation of gene expression in prokaryotes (Lac and tryptophan operon)

Unit IV

- Genetic engineering: Gene cloning
 - Cloning vectors
- Restriction endonucleases, nomenclature, staggered and blunt ended cuts, ligation and examples.
- Recombinant DNA technology
 - Gene amplification:
 - cDNA library.

- Genomic library and
 - Polymerase chain reaction.
- c) Applications of recombinant DNA technology - DNA finger printing and human gene therapy.

Unit V

Animal cell, Tissue and organ culture: History of animal cell and organ culture; requirements; characteristics of animal cell culture, culture media (natural and synthetic); sterilization of glassware, equipments, isolation of animal tissue; somatic cell fusion; hybridoma technology.

References:

- Animal Cell Culture – A practical approach, Ed. John R.W. Masters, IRL Press.
- Gunther S. Stent, Molecular Genetics, MacMillan Publishing Co. Inc.
- R.W. Old and S.B. Primrose: Principles of gene manipulation: An introduction to genetic engineering.
- R.A. Meyers (Ed): Molecular Biology and Biotechnology, (VCH Publishers).
- Genetics – Analysis and principles – Robert. J. Brooker, McGraw Hill.
- Principles of Cell and Molecular Biology – L.J.Kleinsmith & V.M.Kish. Harper Collins College Publishers.
- Molecular Cell Biology – Lodish, Berk, Matsudaira, Kaiser Krieger, Scott, Zipursky, Darnell, W.H. Freeman and Co.

PRACTICALS

Duration: 4 hours

Max. Marks: 50

Min. for pass: 18

Objectives:

To develop the molecular and biotechnological techniques and to develop skills of preparing media, separation of nucleic acids and culture of animal cells.

Course Content:

- Study of DNA by Feulgen reaction in the salivary gland chromosomes.
- Preparation and use of culture media for microbes.
- Preparation and use of culture media for animal tissues.
- Media preparation and sterilization and, Inoculation.
- Cell culture techniques – Design and functioning of tissue culture laboratory, cell proliferation measurements, culture media preparation and cell harvesting methods.
- Molecular separations by chromatography, electrophoresis, precipitation etc.
- Isolation and staining of bacteria.

8. Isolation of genomic DNA.
9. Isolation of milk protein from the milk sample.
10. Microtomy: Fixation, embedding, sectioning and staining.
11. Separation of plasma by centrifugation.
12. Separation of biomolecules by paper and gel chromatography
13. Separation of serum by using centrifuge.
14. Estimation of protein by Biuret method.
15. Determination of pH value of different water samples, blood, urine and saliva.
16. Qualitative tests for carbohydrates.
17. Qualitative tests for proteins.
18. Qualitative tests for lipids.
19. Effect of temperature on the activity of enzyme.
20. Isolation of glycogen from toad's liver.
21. Students are expected to visit different laboratories (RRL, CSIR, ICMR, Science centres etc.), National parks and other places (for studying terrestrial and aquatic fauna).

4. BOTANY

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hours	50	36
Paper II	3 hours	50	
Practical	4 hours	50	18

PAPER I : BIOTECHNOLOGY AND MOLECULAR BIOLOGY

Duration: 3 hours

Max. Marks: 50

Note: In this question paper ten questions will be set two questions from each unit. Candidates have to answer five questions taking one question from each unit.

Unit I

Tools and Techniques in Plant tissue culture, Media preparation, Sterilization techniques: Sterilization of glass wares medium and explants, Aseptic manipulation and culture maintenance: inoculation and subculture.

Cell culture: callus, suspension culture in Bioreactor, Growth cycle of a culture system

Unit II

Concept of cellular totipotency, Methods and applications of micropropagation, Haploid production, zygotic embryo culture, Endosperm culture, production of secondary metabolites, somatic embryogenesis and synseeds.

Unit III

Genetic transformation using plant tissue system. Direct DNA transfer

(biolistics, electroporation). Agrobacterium mediated gene transfer, protoplast culture, somatic hybridization and cybridization, germ plasm storage.

Unit IV

An overview of biotechnology, Tools and techniques of genetic engineering, recombinant DNA technology, Methods and applications in agriculture, horticulture, pharmaceuticals and environment management, genetic markers, PCR.

Unit V

DNA finger printing, concept of genomics, techniques of gene mapping, applications of biotechnology and human genome project, proteomics.

PAPER II: ECOLOGY AND UTILIZATION OF PLANTS

Duration: 3 hours

Max. Marks: 50

Note: There will be ten questions in all, two from each unit. Students have to answer five questions, selecting one from each unit.

Unit I

Plants and environment: Atmosphere (gaseous composition), water (properties of water cycle), light (global radiation, photosynthetically active radiation), temperature, soil (types, origin & development, soil profiles, physico-chemical properties), and biota.

Morphological, anatomical and physiological responses of plants to water (hydrophytes and xerophytes), temperature (thermoperiodicity and vernalization), light (photoperiodism, heliophytes and sciophytes) and salinity.

Unit II

Population ecology: Growth curves; ecotypes; ecads and plant indicators.

Community ecology: Community characteristics, frequency, density and classification, cover, life forms, biological spectrum; ecological succession.

Unit III

Ecosystems: Structure and function; Abiotic and biotic components; food chain, food web, ecological pyramids, energy flow; biogeochemical cycles of carbon, nitrogen and phosphorus.

Phytogeographical regions of India.

Vegetation types of India: Forests and grasslands, Biodiversity in general,

Intellectual property Rights (IPR) and Patent (in brief).

Unit IV

Utilization of Plants: Origin of cultivated plants.

Food plants: Rice, wheat, maize, potato, sugarcane.

Fibres: Cotton and jute.

Vegetable oils: Groundnut, mustard and coconut.

Unit V**General account of sources of firewood, timber and bamboos.****Spices:** General account.**Medicinal plants:** General account.**Beverages:** Tea and coffee. General account**Rubber:** General account.**PRACTICALS****Duration: 4 hours****Max. Marks: 50****Min. for pass: 18****Practical exercises:**

1. Demonstration of the technique of micropropagation by using different explants, e.g. axillary buds, shootmeristems.
2. Demonstration of the technique of anther culture.
3. Demonstration of root and shoot formation from the apical and basal portion of stem segments in liquid medium containing different hormones.
4. Isolation of protoplast from different tissues using commercially available enzymes.
5. Demonstration of hairy root culture.
6. Demonstration of DNA isolation from plant.
7. To study the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkair's standard frequency diagram.
8. To estimate importance Value Index for grassland species on the basis of relative frequency, relative density and relative biomass in protected and grazed grassland.
9. To determine moisture content and water holding capacity of grassland and woodland soil.
10. To study the vegetation structure through profile diagram.
11. To estimate dust-holding capacity of leaves of different plant species.
12. **Food Plants:** Study of the morphology, structure and simple microchemical tests of the food storing tissues in rice, wheat, maize, potato and sugarcane, Microscopic examination of starch in these plants (excepting sugarcane).
13. **Fibres:** Study of cotton flowers, sectioning of the cotton ovules/developing seeds to trace the origin and development of cotton fibres. Microscopic study of cotton and test for cellulose. Sectioning and staining of jute stem to show the location and development of fibres. Microscopic structure. Tests for lignocellulose.
14. **Spices:** Examine black pepper, cloves, cinnamon (hand sections) and opened fruits of cardamom and describe them briefly.
15. **Preparation of an illustrated inventory of 10 medicinal plants used in indigenous systems of medicine or allopathy:** Write their botanical and common names, parts and diseases/disorders for which they are

prescribed.

16. **Beverages:** Section boiled coffee beans and tea leaves to study the characteristic structural features.

5. MATHEMATICS

Scheme	Exam Duration	Max. Marks	Min. for Pass
Paper I	3 hrs	75	54
Paper II	2 hrs	75	

PAPER I (NUMERICAL ANALYSIS AND PROGRAMMING IN C)**Duration: 3 hrs****Max. Marks: 75**

Note: In this question paper ten questions will be set, two questions from each unit. Candidates have to answer five questions in all taking at least one question from each unit.

- Unit I** Difference operators and factorial notation, difference, Relation between difference and derivatives, Difference of polynomial, Newton's formulae for forward and backward interpolation for equal intervals.
- Unit II** Divided difference, Relation between divided differences and simple differences, Newton's general interpolation formula, Lagrange's interpolation formula, Gauss central difference formula, Stirling and Bessel interpolation formulae, Inverse interpolation.
- Unit III** Numerical differentiation and integration, trapezoidal, Simpsons's 1/3, 3/8 rules, Weddle's rule, Solution of Algebraic and Transcendental equations, Bisection method, Regula-Falsi Method, Newton-Raphson method.
- Unit IV** Programmer's model of a computer. Algorithms, Flow charts, Data types, Arithmetic and input/output instructions, Decision control Structures.
- Unit V** Decision statements, logical and conditional operators, Loop, case control structures, functions, recursion, pre processors, arrays, puppeting of strings, structures, pointers, file formatting.

PAPER II (MECHANICS)**Duration: 3 hrs****Max. Marks: 75**

Candidates have to answer five questions in all taking at least one question from each unit.

- Unit I** Moments and Products of Intertia, The momental Ellipsoid, Equipomental Systems, Principal axes.
- Unit II** D'Alembert's principle, The general equation of motion of a rigid body, motion of the centre of inertia and motion relative to the centre of inertia. Motion about a fixed axis. The compound pendulum. Centre

of percussion.

Unit III Motion of a rigid body in two dimensions under finite and impulsive forces. Conservation of Momentum and Energy, Lagrange's equations, Initial Motions.

Unit IV Pressure equation, Condition of equilibrium, lines of force, homogeneous and heterogeneous fluids, elastic fluids, surface of equal pressure, fluid at rest under action of gravity, rotating fluids, Fluid pressure on plane surfaces, Centre of pressure, resultant pressure on curved surfaces.

Unit V Equilibrium of floating bodies, Centre of buoyancy, Surface of buoyancy, Stability of equilibrium of floating bodies, Meta Centre, work done in producing a displacement Vessel containing liquid.

6. EDUCATION AND INDIAN SOCIETY

Duration : 3 hours

Max. Marks : 75

Min. for pass : 27

Note: Ten questions will be set in all, two questions from each unit. Candidates have to answer five questions taking one question from each unit.

Objectives:

On completion of the course the student teacher will be able to

- understand the relationship between education and society
- acquaint with the philosophy of Indian thinkers
- analyse the role of family and society in modernization.
- promote international understanding through education.
- appreciate the role of teacher in promoting social change

Unit I Basic Concepts Used in Education

Education, schooling and training : aims, objectives, values, ethics and logical analysis of relationship between mind and matter.

Secularism, democracy, equality, egalitarianism, culture, social institutions, social grouping, social behaviours, social and moral values, quality of life, social justice and their educational implications.

Salient features of Emerging Indian Society – our cultural heritage, its compositeness, unity in diversity, our philosophical tradition, central teachings of Indian Philosophies: Contribution of Indian philosophical thinkers in curriculum development and teaching.

Indian-Social system and the place of social therein. Types of schools and their pattern of relationship with social system.

Unit II: Philosophy and Education

Major Philosophical Systems – their salient features and their impact on education, Realism with reference to Aristotle and Jainism, Naturalism with reference to the views of Rousseau and R. N. Tagore, Idealism with reference to Plato, Socrates and advaita philosophy, Pragmatism with reference to Dewey, Humanism and Buddhists.

Educational thinkers and their contribution in developing principles of

education – M.K. Gandhi, Swami Vivekanand, Sri Aurobindo, Dr. Zakir Hussain and J.Krishnamurti.

Unit III: Education and modernization

India as a modernizing nation, the constitutional provisions on education and the teacher's role in assisting the state in the implementation: aims of education relevant to modern Indian society.

Educational needs of modern India, role of society, family and school as a social system in the development of child as an individual learner and citizen. Process of socialization of the child : A cultural analysis.

Unit IV: Education and social change

Concept of social change, social mobility, social control, cultural lag, social stratification, caste and class structure in Indian society.

Social change in Indian Society trend study. Impact of social change on Education and educational agencies.

Education for Modernization attributes of modernity, impact of social change on modernization.

Equality of educational opportunity: Problems of access, participation and success.

Education for National development, Education for emotional and National integration.

Education for peace, disarmament and International understanding.

Unit V: Education and National Concerns

Promoting equality and equity, protective discrimination of compensatory education.

Universalisation of Elementary Education : Dealing with educational wastage due to dropout and stagnation, enrolment, retention and achievement.

Universalisation of Secondary education: resources and commitment Meeting the educational needs of special groups, disadvantaged (women, SC/ST) and the disabled.

Fostering secular and scientific outlook.

Population increase small family norm and quality of life.

Attaining excellence in learning and instruction.

Vocationalisation of education

Note : Each concern is to be discussed in terms of significance, inherent values and emerging issues based on education commission reports and the National Policy on Education (NPE).

Reference books:

1. Aggarwal, J.C. 1988. "Theory and Principles of Education", Vikas Publishing House.
2. Tarachand, 1990. "Principles of Teaching" Anmol Publications.
3. Moore, W.E. 1965. Social Change, Prentice Hall.
4. Aggarwal, J.C. 1996. Philosophical and Sociological Bases of Educations, Vikas Publishing House.

5. Govt. of India, 1964-66. Report of National Education Commission, NCERT, New Delhi.
6. Bhanu Pratap Singh, 1990. Aims of Education in India, Delhi: Ajanta Publications.
7. Shikk, P.D. 1976. Towards the New Pattern of Education India, New Delhi: Sterling Publishers.
8. NCERT, 1984. The Teacher and Education in Emerging Indian Society.
9. Basu, D.D. 1976. Introduction to the Constitution of India, New Delhi: Prentice Hall.
10. Brown, F.G 1990. Educational Sociology, New Delhi: Prentice Hall.

7. SCHOOL MANAGEMENT

Duration : 3 hrs. Max. Marks : 75 Min. for pass : 27

Note:- Ten questions will be set in all, two from each unit. Candidates have to answer five questions, one from each unit.

Objectives

- To acquaint the students with the basic principles of school management.
- To enable the students to organize different school activities.
- To develop awareness among students regarding different aspects of school management

Unit I

Educational Management: Concept and function of educational management. Basis of management – planning, organization, control, decision making and financing.

Institutional Planning: Principles, planning, execution and evaluation, School complex and clusters-concept, need and use for resource generation.

Unit II

Leadership in School: Concept, need and importance of leadership, Dimensions and styles of leadership at different levels Role of leadership in school effectiveness. Cost management in education: its impact on school, teacher and students.

Unit III

Management of Time and Resources

- (a) **Time Management:** Importance and principles, types of time schedule for teachers, students and administrative personnel, time schedule for curricular, co-curricular activities.
- (b) **Management of resources:** Types of resources-human and material, principles, organization and monitoring of resources (school building, library laboratories, hostels and play grounds) to optimum level.
- (c) Issues related to management of time and resources (focus on practical issues)

Unit IV

Management of School Activities

Arrangement of morning activities, assembly, class arrangement and monitoring.

Admission, classification and promotion of students, school office and records.

Co-curricular activities: importance, values, types of activities (games, sports, literary, cultural scientific, recreational, educational and their relevance to curriculum)

Discipline-Concept, importance and principles, techniques of maintaining discipline in the school and class room, Role of students council and association in school climate.

Unit V

Management of Health and Physical Education

1. Meaning, definition of Health and Health Education.
2. Objectives of health Education
3. Importance of Health Education.
4. School Health Programme
5. First aid and safety education.
6. Sex education
7. Meaning, definition, aims and objectives of Physical Education
8. Physical fitness, test of physical fitness.
9. Organisation of games and sports
10. Basic fundamentals, rules and regulation related to different games and sports (selected as per available resources)
11. Balanced diet
12. Yoga and Meditation
13. Stress Management

REFERENCE BOOKS

1. Aggarwal, J.C. : Educational Administration, School organization and supervision, Dhanpat Rai and Sons. Delhi (1977)
2. Awasthi. A. : Public Administration, Laxmi Narayan Aggarwal, Agra (1974)
3. Bagley : Class Room Management MacMillan. New York.
4. Blumberg A. & Green Field W. The Effective Principal. Allyn Bacon. London, 1986.
5. Bush T. & Others : Approaches to School Management Harper & Row Publishers.
6. George: I.I.L. & Robert A.S. : Motivation & Organisational Climate. Harvard University, Boston, 1976.
7. Khan, M.S. : Educational Administration, Asia Publishing House, New Delhi, c) 1990
8. Kochhar K.S. : Secondary School Administration, Sterling, New Delhi, 1982.
9. Sapra C.L. & Dudani. S.S. : Education of the Future : Management Challenges, National Book Org., New Delhi, 1984.
10. Sidhu, K.S. : School Organisation & Administration sterling, New Delhi,

1982.

11. Park, JE: Preventive and Social Medicine, Friends Publication New Delhi 1995
12. Singh, Ajmer: Essential of Physical Educations, Friends Publication, New Delhi, 2002

8. INTERNSHIP IN TEACHING

Duration: 6 weeks **Sessional Marks:** 200 **Min for pass:** 80

Objectives

To provide field experience to pupil teachers for the development of essential professional competencies and skills.

Organization

- Total duration of internship - 6 weeks
- Pre-Internship - 1 week
- Internship - 5 weeks

Internship Activities

- Teaching
- Evaluation
- Participation in School activities

Lessons:

- 40 Lessons - 20 in each subject
- 2 criticism lessons - one in each subject
- Total lessons - 42.

Post-Internship

Seeking reaction of students and supervisors through conference mode.

Evaluation and scheme of assessment:

The scheme of assessment will be as follows:

- A.
1. Regular classroom teaching: 120 Marks
 2. Criticism lesson (one in each subject- 15 each): 30 Marks
 3. Teaching aids (one in each subject – 15 each): 30 Marks

Assignments: -

Any two of the following: 20 Marks (10 each)

- i) Achievement test
 - ii) Lab. Study
 - iii) Investigatory project
 - iv) Critical study of secondary syllabus of a subject with a view to environmental/peace education
- Total 200 Marks

Note:

Teaching aids should not be prepared by using Thermocole sheet since it is non-biodegradable. No credit will be given for models/charts prepared on or using thermocole sheet.